Proposed Rosemont Copper Project

DRAFT- NOT FINAL UNTIL INITIALED BY BEV EVERSON

ID Team Meeting
November 12, 2008

Approved by:
___ Bev Everson
___ Tom Furgason

File in:
___ Administrative Record

Attendees:

Forest Service	SWCA	Other
See sign-in sheet		

Topics Discussed:
Technology Transfer Meeting
- Geology
- Hydrology
- Geochemistry
- Permitting
- Facilities design
- Noise
- Traffic
- Biology

Decisions Made:
- N/A

Action Items/Assignments:
- None made

Proposed Rosemont Copper Project Technology Transfer Meeting
PROPONENT SIGN-IN

11/12/2008 — Kendra L Baumgart inserted date

First Name	Last Name	Company	Initials
Aaron		*M3 Engineering*	
Alyssa	Kohlman	*Tetra Tech*	AK
Bob	Sculley	*Tetra Tech*	RS
Brian	Lindenlaub	*WestLand Resources*	BSL
Craig	Hunt	*M3 Engineering*	
Daniel	Roth	*M3 Engineering*	DKR
David	Krizek	*Tetra Tech*	DK
David	Moll	*M3 Engineering*	
Derek	Wittwer	*AMEC*	
Fermin	Samorano	*Rosemont Copper Company*	
Hale	Barter	*E.L. Montgomery & Associates*	HWB
Jaime	Wood	*Environmental Planning Group (EPG)*	
Jamie	Sturgess	*Rosemont Copper Company*	
Jamie	Monte	*Tetra Tech*	JM
Jeff	Fehmi	*University of Arizona*	[illegible]
Jennifer	Malleo	*Strongpoint*	
Jim	Davis	*E.L. Montgomery & Associates*	[illegible]
Jim	Tress	*WestLand Resources*	
Joel	Carrasco	*Tetra Tech*	JAC
Juliet	McKenna	*E.L. Montgomery & Associates*	
Kathy	Arnold	*Rosemont Copper Company*	KAA
Kekoa	Anderson	*Tetra Tech*	KA
Kristie	Kilgore	*eec*	KAK
Lance	Newman	*Rosemont Copper Company*	
Lauren	Wood	*Environmental Planning Group (EPG)*	
Lauren		*University of Arizona*	LP.
Louis	Thanukos	*Applied Environmental Consulting (AEC)*	
Mark	Stevens	*Rosemont Copper Company*	MGS
Mark	Thomasson	*E.L. Montgomery & Associates*	
Mark	Myers	*E.L. Montgomery & Associates*	
Mark	Williamson	*Tetra Tech*	MAW
Michael	Diekhaus	*Tetra Tech*	MLD
Rod	Pace	*Rosemont Copper Company*	RP
Seri	Parks	*Tetra Tech*	SR
Shannon	Breslin	*Tucson Electric Power*	SY
Taryn		*University of Arizona*	[illegible]
Tony	Ottinger	*M3 Engineering*	[illegible]
Tim	Allen	Montgomery	TJA
DAVID / MARY	BOST / ROWLEY	TETRA TECH / Strongpoint	[illegible]

Jennifer Malko Strongpoint LLC JM

Bob Schmalzel WestLand Resources.

ALAN BELAUSKAS CORONADO NATIONAL FOREST

ERIK BAKKEN TEP

Ed Beck TEP

Proposed Rosemont Copper Project
ID Team Meeting
11/12/2008 Kendra L. Bourgart inserted date

First	Last	Role	Company	Initial
Alan	Belauskas	*Noise*	Coronado National Forest	AB
Andrea	Campbell	*NEPA Compliance/FOIA Officer*	Coronado National Forest	
Ben	Gaddis	*NEPA Planner*	SWCA Salt Lake City	BMG
Bev	Everson	*ID Team Leader*	Coronado National Forest	BAE
Bob	Lefevre	*Air Resources, Clean Water Act*	Coronado National Forest	[illegible]
Cara	Bellavia	*Social & Economic Environments*	SWCA Phoenix	CB
Charles	Coyle	*NEPA Planner*	SWCA Phoenix	CPC
Chris	LeBlanc	*Heritage*	Coronado National Forest	
Dale	Ortman	*Engineering*	SWCA Subcontractor	DO
Dave	Morrow	*Air Resources*	SWCA San Lois Obispo	DM
Debby	Kriegel	~~*Light (Night Skies)*~~	Coronado National Forest	DK
Deborah	Sebesta	*Vegetation, Reclamation, Wildlife*	Coronado National Forest	DS
Eli	Curiel	*Hazardous Waste, Mining*	Coronado National Forest	EC
Elisha	Wardle	*NEPA Planner*	SWCA Salt Lake City	EW
Geoff	Soroka	*Vegetation, Reclamation, Wildlife*	SWCA Tucson	[illegible]
George	McKay	*Access/Lands/Realty*	Coronado National Forest	[illegible]
Glenn	Dunno	*Data Management*	SWCA Flagstaff	
Harmony	Hall	*NEPA Planner*	SWCA Flagstaff	HH
Heidi	Schewel	*Media*	Coronado National Forest	
Janet	Jones	*Admin Support*	Coronado National Forest	
Jeanine	Derby	*Forest Supervisor*	Coronado National Forest	
Jeff	Connell	*Social & Economic Environments*	SWCA Phoenix	JC
Jennifer	Ruyle	*Forest Planner*	Coronado National Forest	
Jerome	Hesse	*Geology*	SWCA Tucson	
Joe	Ezzo	*Heritage*	SWCA Tucson	
John	Able	*Communications Team*	Coronado National Forest	[illegible]
John	MacIvor	*SWCA Project Leader*	SWCA Subcontractor	[illegible]
Keith	Graves	*Recreation, Social & Economic Env.*	Coronado National Forest	[illegible]
Ken	Houser	*Managing Principal*	SWCA Phoenix	KH
Ken	Kertell	*Wildlife Resources*	SWCA Tucson	
Kendall	Brown	*Range*	Coronado National Forest	DKB
Kendra	Bourgart	*Team Admin Asst*	Coronado National Forest	KLB
Kevin	Serrato	*NEPA Planner*	SWCA Tucson	
Larry	Jones	*Wildlife Resources*	Coronado National Forest	[illegible]
Marcie	Bidwell	*Recreation*	SWCA Durango	M Bidwell
Mary	Farrell	*Heritage*	Coronado National Forest	MMF
Matt	Petersen	*NEPA Planner*	SWCA Salt Lake City	[illegible]
Melissa	Reichard	*Project Administrator*	SWCA Tucson	[illegible]
Ralph	Ellis	*Transportation/Engineering*	SWCA Phoenix	[illegible]
Reta	Laford	*Deputy Forest Supervisor*	Coronado National Forest	
Rion	Bowers	*Clean Water Act Compliance*	Coronado National Forest	RJB
Gordon	Cherniac		Cherniac + Assoc	[illegible]
Tami	Emmett	Lands	CNF	[illegible]

Proposed Rosemont Copper Project
ID Team Meeting

Roxane	Raley	*Mailing Database*	Coronado National Forest	
Salek	Shafiqullah	*Hydrologist, Hydro geologist*	Coronado National Forest	SS
Shane	Lyman	*Fire/Fuels*	Coronado National Forest	
Suzanne	Griset	*Heritage*	SWCA Tucson	[illegible]
Tami	Emmett	*Access/Lands/Realty*	Coronado National Forest	
Teresa Ann	Ciapusci	*Ecosystem Management & Planning*	Coronado National Forest	
Tom	Euler	*Heritage*	SWCA Tucson	[illegible]
Tom	Furgason	*SWCA Project Manager*	SWCA Tucson	✓
Tom	Skinner	*Water Resources/Riparian*	Coronado National Forest	[illegible]
Walt	Keyes	*Transportation/Engineering*	Coronado National Forest	WK
William	Gillespie	*Heritage*	Coronado National Forest	[illegible]
Cori	Hoag	*Engineering*	SRK- SWCA Subcontractor	CKH
Dawn	Garcia	*Engineering*	SRK- SWCA Subcontractor	DHG
Claudia	Stone	*Engineering*	SRK- SWCA Subcontractor	CS
Rebecca	Miller	*Engineering*	MWH- SWCA Subcontractor	RM
Tim	Hawthorne	*Engineering*	MWH- SWCA Subcontractor	TH
Toby	Leeson	*Engineering*	MWH- SWCA Subcontractor	[illegible]

Technology Transfer Meeting

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Rosemont Project

November 12, 2008

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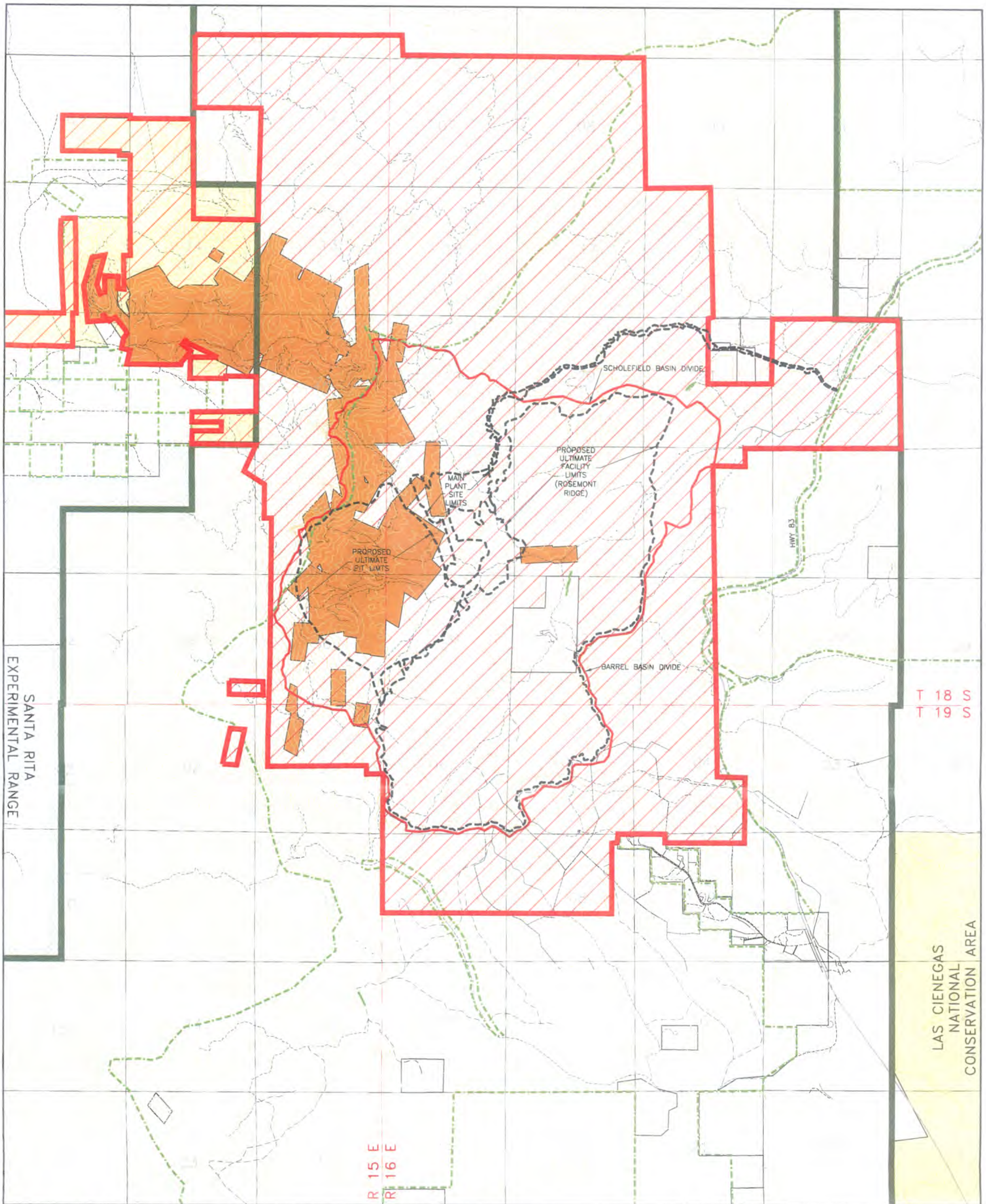
Technical Transfer Presentations

November 12, 2008

Time	Subject	Presenter	Company
8:00-8:15	Welcoming Remarks	Bev Everson	Forest Service
8:15-8:30	Welcoming Remarks	Jamie Sturgess	Rosemont Copper
8:30-8:35	Logistics/Introduction	Kathy Arnold	Rosemont Copper
8:35-8:55	Geology Update	Mark Stevens	Rosemont Copper
8:55-9:20	Geotechnical Analysis	Alyssa Kohlman	Tetra Tech
9:20-9:45	Site Hydrology	Jim Davis	Montgomery
9:45-10:00	Site Groundwater Modeling	Mark Thomasson	Montgomery
10:00-10:15	Water Supply Plan and West Side Hydrology	Mark Myers / Juliet McKenna	Montgomery
10:15-10:30	West Side Groundwater Modeling	Hale Barter	Montgomery
10:30-10:40	Break		Rosemont
10:40-11:25	Geochemistry/Pit Lake Model	Mark Williamson	Tetra Tech
11:25-11:45	Groundwater Permitting	Kristie Kilgore	ecc
11:45-12:45	Lunch Break		
12:45-12:50	Logistics/Introduction	Kathy Arnold	Rosemont Copper
12:50-1:15	Facilities Engineering (status)	David Moll	M3
1:15-1:45	Dry Stack Tailings	Derek Whitwere	AMEC
1:45-2:09	Heap Leach	Joel Carrasco	Tetra Tech
2:05-2:30	Air Permitting / Modeling	Louis Thanukos	AEC
2:30-2:50	Powerline / CEC Permit	Jaime Wood	EPG
2:50-3:00	Break		
3:00-3:20	Noise Analysis	Bob Sculley / Michael Diekhaus	Tetra Tech
3:20-3:45	Traffic Analysis	Kekoa Anderson / Seri Parks	Tetra Tech
3:45-4:30	Biological Studies	Jim Tress / Brian Lindenlaub	Westland
4:20-4:50	Plant Studies	Jeff Fehmi	UofA
4:50-5:00	Closing Remarks	Bev Everson	Forest Service



LEGEND

- ROSEMONT UNPATENTED CLAIMS
- PATENTED CLAIMS
- ROSEMONT PRIVATE LAND
- CORONADO NATIONAL FOREST BOUNDARY
- CORONADO NATIONAL FOREST
- BLM
- STATE TRUST
- PRIVATE LAND
- GRAZING LAND BOUNDARY
- FACILITY FOOTPRINT

N

SCALE
2000' 0 2000' 4000'

NOTE: EXISTING GROUND CONTOUR INCREMENTATION IS 100'

MARCH 2008

FIGURE 1
LAND POSITION MAP
ROSEMONT COPPER PROJECT

Jamie Sturgess

Vice-President, Sustainable Development

Jamie has over 25 years of industry experience in the areas of environmental management, regulatory compliance, pollution control and project management. His career has spanned from research field biologist to site environmental manager for large mining operations, and included senior exectuive positions with Cyprus Climax Metals and EnviroNet. Jamie was formerly with Stantec Consulting in the Environmental Management group, doing extensive permitting work in Arizona over the last two decades. He has earned both his Masters in Resource Management Ecology and his Bachelors in Renewable Natural Resource Management from the University of California at Davis.

Technology Transfer Meeting
November 12, 2008

History and Ownership
Helvetia and Rosemont Mining District

- Congress recognizes Helvetia and Rosemont Mining Districts - 1880
- Southern Arizona led the nation's copper production - 1900
- Rosemont District mined - 1870 through 1950
- First mining claims:
  - Narragansett, 1879
  - Eclipse, 1884
  - Backbone, 1885
- Recent History:
  - Banner Mining Company, 1961
  - Anamax, 1973 - 1986
  - Asarco, 1988 - 2004
  - Rosemont Copper, 2005

Old Rosemont, ca. 1900
Store and warehouse, center;
Rosemont Hotel, right.

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Rosemont Ownership

- Rosemont Copper Company is an Arizona Corporation and a wholly owned subsidiary of Augusta Resource Corporation
- Rosemont Copper Company has offices in Tucson and Denver
- Augusta Resource Corporation is traded on the American and the Toronto Stock Exchanges using the stock symbol AZC

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Mine Plan of Operations

- Rosemont Copper submitted the Mine Plan of Operations to the US Forest Service on July 11, 2007.
- The MPO includes the Rosemont Copper project progressive design, conservation, and sustainability initiatives.
- The MPO consists of several documents:
  - The Mine Plan of Operations
  - The Infrastructure Plan
  - The Reclamation Plan
  - Additional Information requested by the Forest Service

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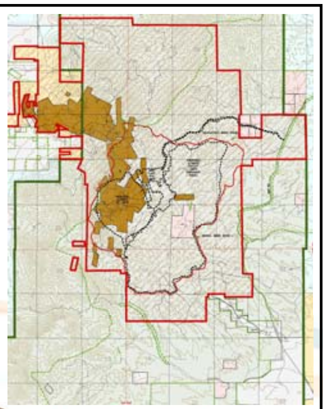
Rosemont Land Ownership

- Mining Property:
  - 132 patented claims, covering just under 2,000 acres
  - 905 unpatented claims, covering more than 12,000 acres
  - Other ranchlands covering approximately 800 acres
- Ranching Property:
  - Private ranchland property covering approximately 800 acres (unpatented mining claims cover some of the ranchlands)
  - Grazing rights for 30,000 acres



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Rosemont Production

Product	Annual Metal Production
Copper Concentrate	220,000,000 pounds
Copper Cathode	14,000,000 pounds
Molybdenum Concentrate	5,000,000 pounds
Silver	3,500,000 ounces
Gold	15,000 ounces

- Sulfide ore processing rate = 75,000 tons per day
- Oxide ore process rates = 51,000 tons per day peak (Year 1), all ore placed by year 6
- Mining rate = 322,000 tons per day

Mine Plan of Operations / Feasibility Study – July 2007

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Economic Impact

- Rosemont Employment:
  - 500 people directly
  - 1500 people indirectly
- Rosemont provides 5% of the copper used in the US
- Rosemont will provide a $487 million annual impact to Arizona's economy
- Arizona state and local governments will receive approximately $589 million in taxes over the life of the mine
- Federal taxes are estimated at $1.6 billion over the life of the mine

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Current Economic Impact for Local Firms

- Rosemont currently is using a number of local firms for engineering and other portions of the project
- These firms employ hundreds of people.
- Some of those firms include:
  - M3 Engineering
  - Mountain States R&D International
  - Tetra Tech
  - AMEC
  - WestLand Resources
  - Applied Environmental Consulting
  - E.L. Montgomery and Associates
  - Strongpoint Public Relations
  - Fennemore Craig, PC
  - Sonoran Pump Supply
  - Darling Environmental and Survey
  - Call and Nicholas
  - DM Engineering
  - SkylineLabs
  - Securitas
  - Western Refining
  - Stantec
  - Cooper Aerial
  - Verdad Group, L.L.C.
  - EPG
  - Mountain View Tours
  - Old El Paso Barbecue
  - Bonesteel
  - Navigant
  - University of Arizona
  - Geomechanics Southwest
  - Verizon
  - Fedex-Kinkos
  - Alphagraphics
  - Southwest Exploration Services
  - Turner Laboratories
  - Reprographics
  - Physical Resource Laboratories
  - Metcon
  - Boart Longyear
  - Lang Drilling
  - Layne Drilling
  - Zonge Geosciences, Inc.

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Current Community Involvement Activities

- Rosemont has an active community involvement program supporting local charities and activities.
- We hold memberships in a number of community organizations
- Corporate contributions support primarily education, the extractive industries, necessary community service, or involve areas around our site of operation
- Examples include:
  - The Arizona Trail
  - The University of Arizona Athletics
  - The University of Arizona College of Engineering
  - Rocky Mountain Elk Foundation
  - Tucson SME Chapter
  - Chicanos Por La Causa
  - Arizona Opera
  - Tucson Rough Riders
  - SME Diggers & Duffers Golf Tournament
  - Tucson Gem & Mineral Show
  - Community Water Company
  - Sahuarita Rage ASA Fastpitch
  - Teachers Wish List
  - Community Food Bank
  - El Tour de Tucson
  - Arizona Cattle Growers
  - Tucson Hispanic Chamber of Commerce
  - Metropolitan Tucson Chamber of Commerce
  - Green Valley/Sahuarita Chamber of Commerce
  - Arizona Mining Association
  - Greater Green Valley Community Foundation
  - Tucson Regional Economic Opportunities
  - Green Valley Rotary
  - Volunteer Center of Southern Arizona
  - Arizona-Mexico Commission
  - AMIGOS
  - Metropolitan Pima Alliance
  - Arizona Geological Society

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Thank you

We hope you enjoy the presentations today.

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Kathy Arnold, P.E.
Director of Environmental and Regulatory Affairs

Kathy is originally from Montana and graduated from Montana Tech with B.S. degrees in Mineral Processing Engineering, Computer Science, and Mathematics as well as an M.S. degree in Project and Engineering Management. She worked in the mining industry for 18 years and held a number of positions with a southern Arizona mining company at their active mining properties including: Environmental Engineer, Metallurgist, Crusher General Foreman, Mill Foreman, Truck Shop Technician, and Senior Accountant. She also worked in their Corporate Offices with the development projects group doing permitting and metallurgy on new projects in Bolivia, Chile, French Guiana, and on an in-situ mining project in Casa Grande, Arizona.

After leaving the mining company, she worked as a Senior Environmental Engineer / Project Engineer for Tetra Tech and her areas of specialty included environmental compliance, permitting, training, auditing, and regulatory analysis.

Kathy joined Rosemont Copper Company in February 2008 after managing the Rosemont project for Tetra Tech. She is the Director of Environmental and Regulatory Affairs and works on permitting and compliance activities for Rosemont.

Prior to joining the mining industry, Kathy was the General Manager for the Butte Copper Kings - the professional baseball team that once was in Butte Montana.

Kathy volunteers with Foster Care in Pima County for the Supreme Court System in Arizona and has for the past 5 years. She resides in Tucson with her husband, an Arizona native.

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Mark G. Stevens

Chief Project Geologist

Mark has 28 years of mining industry experience and came to Augusta Resource Corporation from the international mining consulting firm of Pincock, Allen & Holt, where he worked for 18 years. As Chief Geologist at PAH, Mark was responsible for the management and execution of geologic investigations, sampling programs, and computer resource/reserve estimation for operating mines and developing projects. Mark has worked on projects in 25 countries, including metals, coal, and industrial mineral projects. Prior to this, Mark held geologic positions with Getty Mining, Kennecott Mining, the Navajo Nation, and Chevron Resources, where he was responsible for the planning and implementation of exploration and development projects. Mark graduated from Colorado State University with a B.S. degree in geology and from the University of Utah with a M.S. degree in geology. He is a Registered Professional Geologist (Wyoming), a Registered Licensed Geologist (Washington), and a Certified Professional Geologist.

Education: B.S. Colorado State University
M.S. University of Utah

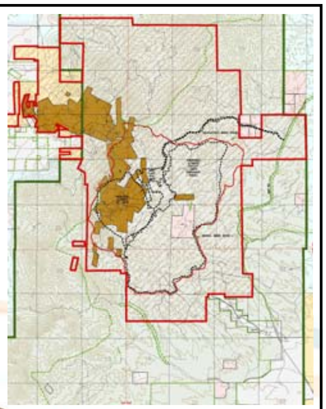
Licenses or Certifications: Registered Professional Geologist in Wyoming
Licensed Professional Geologist in Washington
Certified Professional Geologist

Specialized Training: Gemcom Resource Modelling Training, Sampling Theory & Practices Short Course, OSHA 40 Hour Hazwoper, OSHA 40 Hour Supervisor

Geologic Presentation
November 12, 2008
Mark G. Stevens – Chief Project Geologist

Rosemont Land Ownership

- Mining Property:
  - 132 patented claims, covering just under 2,000 acres
  - 949 unpatented claims, covering more than 12,000 acres
  - Other ranchlands covering approximately 800 acres
- Ranching Property:
  - Private ranchland property covering approximately 800 acres (unpatented mining claims cover some of the ranchlands)
  - Grazing rights for 30,000 acres



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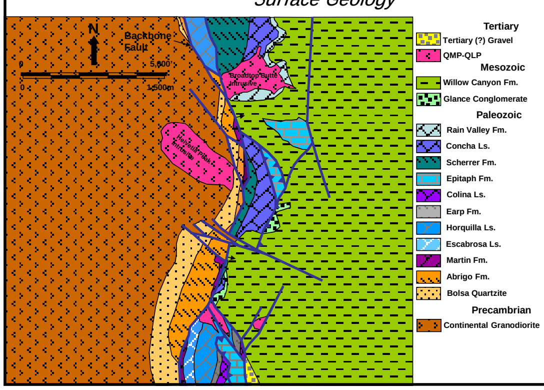
Rosemont-Helvetia Mining District

Surface Geology



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Rosemont Drilling

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Drilling Programs at the Rosemont Property

Company	Time Period	Drill Holes	
		Number	Feet
Banner	1950s-1963	3	4,226
Anaconda	1963-1973	113	136,728
Anamax	1973-1986	52	54,350
ASARCO	1988-1998	11	14,695
Augusta	2005-2008	75	113,876
Total		**254**	**323,875**

All holes drilled at the Rosemont Property have been conducted along lines that are approximately 200 feet apart. Currently the average spacing for holes along these lines is 250 feet.

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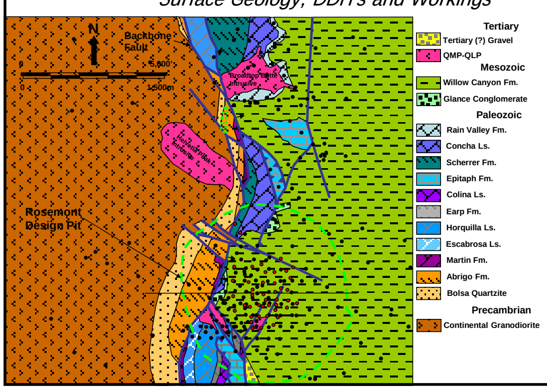
Rosemont-Helvetia Mining District

Surface Geology, DDH's and Workings



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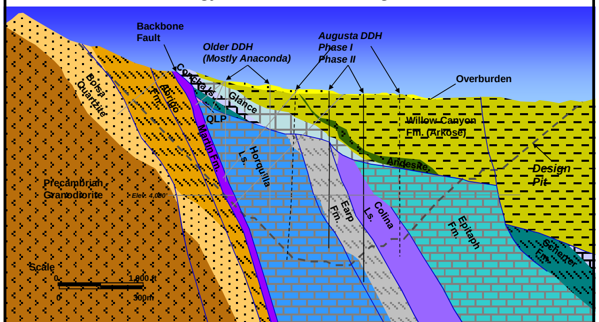
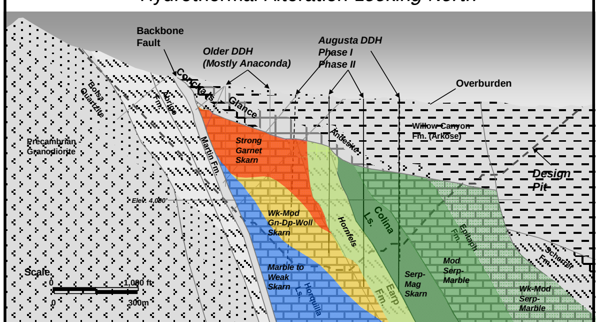
Cross Section 554,825N

Geology and DDH's *Looking North*



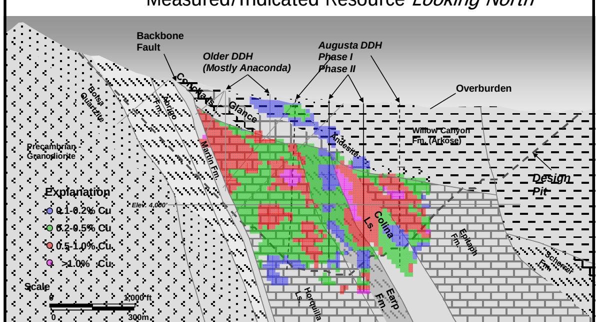
Cross Section 554,825N

Hydrothermal Alteration *Looking North*



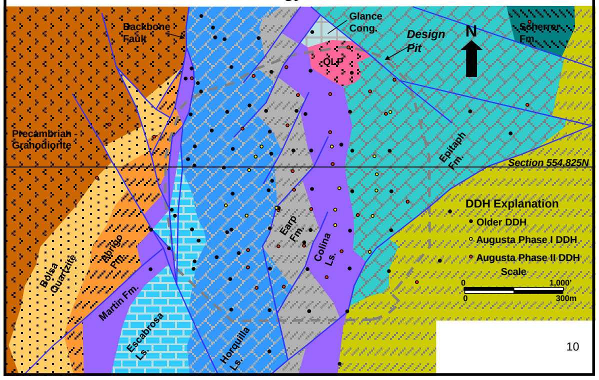
Cross Section 554,825N

Measured/Indicated Resource *Looking North*



Level Plan 4,000' Elevation

Geology and Drill Holes



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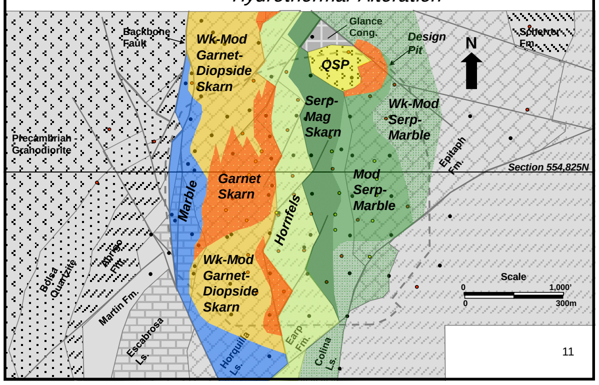
Level Plan 4,000' Elevation

Hydrothermal Alteration



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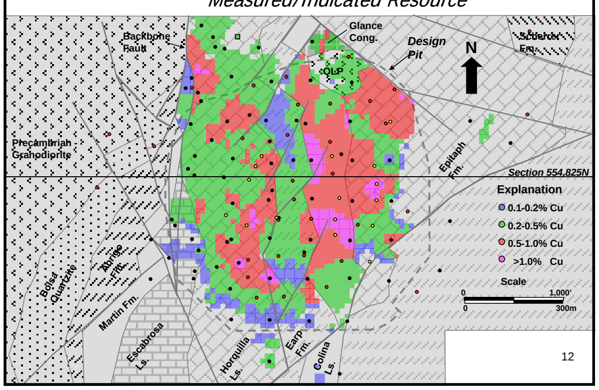
Level Plan 4,000' Elevation

Measured/Indicated Resource



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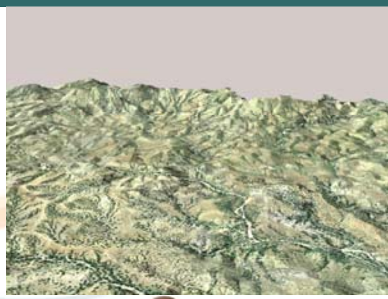
Resource Modelling
(Topographic Surface - perspective view to west)



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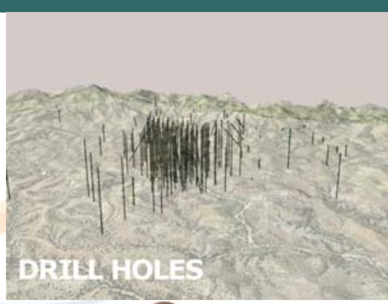
Transparent View Of Drill Holes



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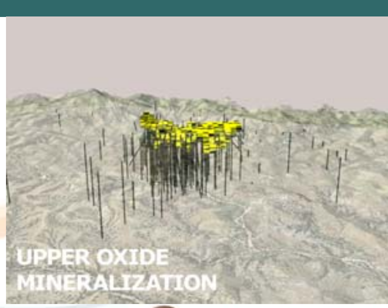
Upper Oxide Mineralization



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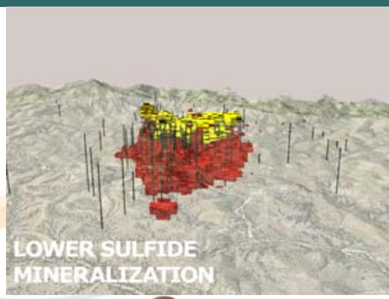
Lower Sulfide Mineralization



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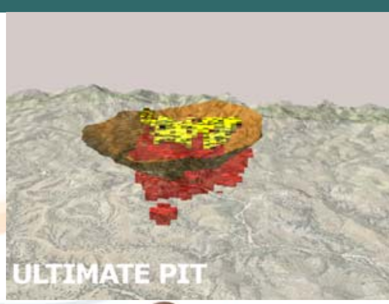
Designed Pit On Mineral Deposit



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Rosemont Mineral Reserves

(2007 Feasibility Estimate)

Classification	Sulfide Reserves				Oxide Reserves	
	Short Tons (thousands)	% Cu	% Mo	Ag oz/t	Short Tons (thousands)	% Cu
Proven	126,120	0.50	0.015	0.14	9,938	0.19
Probable	366,607	0.46	0.015	0.12	39,507	0.17
Total	492,727	0.47	0.015	0.12	49,445	0.18

Proven reserves: ore in place for which the tonnage, grade and shape have been computed from dimensions revealed in outcrops, trenches, underground workings or drill holes. The grade is then calculated from results of adequate sampling to a high degree of confidence.

Probable reserves: ore in place for which tonnage and grade are calculated partly from specific measurements, samples or production data and partly from projection for a reasonable distance on geological evidence and for which the sites available for inspection, measurement and sampling are too widely or otherwise inappropriately spaced to outline the orebody completely or establish its grade throughout.

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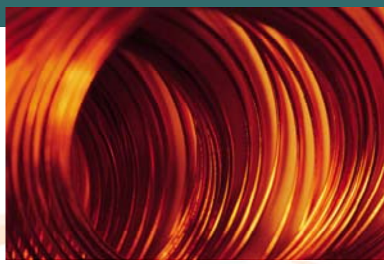
Thank You



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Alyssa Kohlman, P.E.
Geological Engineer

Ms. Kohlman is a Geological Engineer for Tetra Tech in Golden, Colorado. She has both a bachelors and masters degree in Geological Engineering. Alyssa has nine years of professional experience throughout the Western United States and in Latin America. Her technical expertise in mining includes geologic and geotechnical site investigations and testing programs, design of tailings dams and heap leach facilities, including monitoring, permitting, and foundation design.

TETRA TECH

Geotechnical Study

For the Rosemont Copper Project

ROSEMONT COPPER
Resourceful.

By Alyssa Kohlman, P.E. &
Jamie Joggerst

Outline

- Geotechnical Site Investigations
- Geotechnical Parameters
- Geotechnical Analyses
- Geologic Hazards
- Pit Slope Stability by Call and Nicholas, Inc

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Geotechnical Site Investigations

2006 – 2007 (Private Land)
- 10 Drill sites
  - In-situ testing
- 33 Test pits
- Laboratory testing
- 18 Miles of seismic refraction survey lines (geophysics)
- 6 Seismic shear wave sounding locations
- Geologic mapping
- Geologic hazard investigation

2008 (CNF)
- 15 Drill sites
  - In-situ testing
- Laboratory testing
- Magnetic survey (geophysics)

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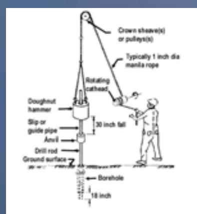
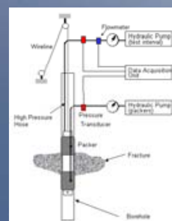
In-Situ Testing

- Standard Penetration Testing (SPT)
  - Measured in-situ relative density or consistency of soils and weathered bedrock



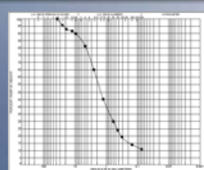
- Permeability tests
  - Packer testing (rock)
  - Falling head tests (soil)



Geotechnical Study

Laboratory Testing

- Soils
  - Gradations
  - Atterberg limits (plasticity)
  - Natural dry density
  - Natural moisture content
  - Proctor (maximum dry density and optimum moisture content of recompacted soils)
  - Direct shear (strength)
- Rock
  - Uniaxial Compressive Strength (UCS)
  - Point load (strength)



Geotechnical Study

Facility Areas

Geotechnical Study

Plant Site Area

- Geology
  - Willow Canyon (Kw)
  - Andesite (Km)
  - Alluvium (Qo & Qa)
  - Breccia Pipe (KTbp)
- 4 Drill sites
- 5 Test pits
- Magnetic survey
- 3 Miles seismic refraction

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Dry Stack Tailings Area

- Geology
  - Willow Canyon (Kw)
  - Apache Canyon (Ka)
  - Mt Fagan (Kr)
  - Alluvium (Qo & Qa)
- 10 Drill sites
- 2 Test pits
- Piezometer installed (measured water level)
- 4 Miles seismic refraction
- 5 Shear wave locations
- In-situ permeability testing

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Heap Leach Area

- Geology
  - Gila Conglomerate (Tg)
  - Willow Canyon (Kw)
  - Apache Canyon (Ka)
  - Alluvium (Qo & Qa)
- 2 Drill sites
- 13 Test pits
- 3 Miles seismic refraction
- In-situ permeability testing

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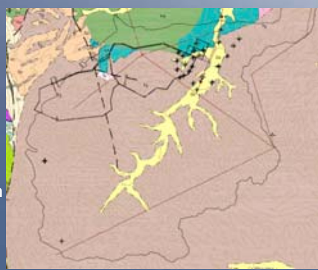
Waste Rock Storage Area

- Geology
  - Gila Conglomerate (Tg)
  - Willow Canyon (Kw)
  - Apache Canyon (Ka)
  - Alluvium (Qo & Qa)
- 6 Drill sites
- 7 Test pits
- 3.5 Miles seismic refraction
- 1 Shear wave location
- In-situ permeability testing



Other Facilities

- Open pit
  - 2 Drill sites
  - 6 Test pits
- Access Road
  - 1 Drill site
  - 4 miles seismic refraction
- PWTS
  - 0.5 miles seismic refraction

Outline

- Geotechnical Site Investigations
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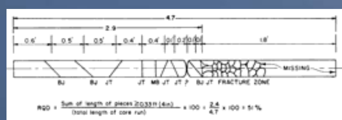
Geotechnical Parameters

- Rock Mass Rating (RMR) (Bieniawski, 1989)
  - Strength of intact rock
  - Rock Quality Designation (RQD)
  - Spacing of discontinuities
  - Condition of discontinuities (weathering, etc.)
  - Groundwater condition



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Rock Mass Rating (RMR)

Very Poor	RMR <21
Poor Rock	RMR 21 – 40
Fair Rock	RMR 41 - 60
Good Rock	RMR 61 - 80
Very Good	Rock RMR > 80

- Rosemont
  - Willow Canyon = 0 to 56
  - Apache Canyon = 28 to 67
  - Mt. Fagan = 36 to 72

RMR = 0

RMR = 70

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Other Geotechnical Parameters

- RMR leads to selection of shear strength parameters for rock
- Shear strength parameters for other materials
- Friction at the base of foundations
- Earth pressure parameter (for retaining structures)

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Outline

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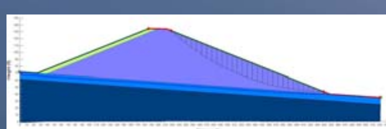
Geotechnical Analyses

- Bearing capacity (for foundations)
  - All major buildings and structures
- Settlement of foundations
  - All major buildings and structures
- Slope stability analyses
- Liquefaction analysis
  - Waste rock storage area
  - Dry tailings stack
  - Heap leach



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Bearing Capacity for Plant Facilities

- Proposed facilities anticipated maximum bearing pressures range from 2,000 – 12,000 psf.
- Allowable bearing capacity calculations performed in accordance with the United States Army Corps of Engineers (USACE) Rock Foundation Engineering Manual (1994).
- All facilities assumed to be founded on poor quality Willow Canyon Formation
- Continuous footings with widths ranging from 3 to 10.5 feet and depths ranging from 2 to 5 feet are suitable for most facilities up to 6,000 psf bearing pressure.

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Bearing Capacity for Plant Facilities (Cont.)

- Mat foundations are recommended for the primary crusher, mill building, concentrate thickeners, tank farm, tailings thickeners, and truck shop.
- Allowable bearing capacities range from ~16,000 psf to 61,000 psf.

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Settlement

- Settlement for continuous footings should be negligible.
- Settlement for mat foundations ranges from 0.10 to 0.49 inches.
- Differential settlement = 50% total settlement for rigid structures and 80% total settlement for flexible structures

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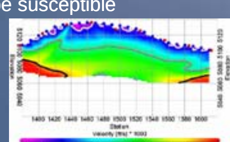
Liquefaction

- Two calculations performed:
  - Based on SPTs and lab data from borings
  - Based on seismic refraction survey
- SPT results: no liquefiable materials on site
- Seismic refraction results: surficial layers in young alluvium (<5 foot depth) may be susceptible
- Surficial layers will be removed / recompacted during site grading activities



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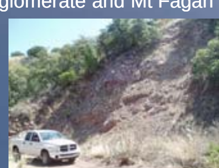
Geologic Hazards

- Defined: A geologic condition, natural or man-made, that poses a potential danger to life and/or property.
- Hazard types assessed for Rosemont
  - Rockfall
  - Abandoned Mine Workings
  - Accelerated Erosion
  - Seismic Hazards
  - Other Hazards

Rockfall Hazards

- Source: Bare rock slopes above pit, talus areas, and observed loose rocks on the ground
- Runout areas: Where ground flattens
- Runout areas extend farther where steep, incised alluvial channels exist.
- Some source areas in Gila Conglomerate and Mt Fagan due to differential weathering
- There are also small areas of localized rockfall in steeply incised alluvial valleys.



Abandoned Mine Workings

- Abandoned Mine Lands (AML) database searched
- Six additional shafts discovered during site investigation work

Accelerated Erosion

- Natural Resources Conservation Service (NRCS) soils maps searched
- Most likely during short intense periods of rainfall
- Low and moderate erosion potential of native soils/rock at site
- Erosion during construction can be mitigated with engineered controls (silt fences, erosion control blankets, etc.)

Seismic Hazard

- BADCT - Two design earthquakes:
  - Minimum design earthquake is the maximum probable earthquake (MPE) Where human life is potentially threatened, the maximum credible earthquake (MCE) should be used.
- MPE is defined as the maximum earthquake that is likely to occur during a 100-year interval (80% probability of not being exceeded in 100 years)
- MCE is the maximum earthquake that appears capable of occurring under the presently known tectonic framework

Seismic – Earthquake Determinations

- MPE is based on a probabilistic analysis (based on past earthquakes)
- MCE is based on a deterministic analysis
  - Determination of seismogenic structures
  - Definition of associated earthquake magnitude
  - Distance between project site and seismogenic source
  - Selection of appropriate attenuation function(s)

Seismic Hazard Cont.

- MPE
  - Heap leach pads
  - Solution collection ponds
  - Diversion ditches, etc.
  - (Useful life < 10 years)
- MCE
  - Waste rock dumps
  - Tailings storage facilities
- Rosemont Peak Ground Accelerations
  - MCE = 0.328g
  - MPE = 0.045 g

Other Hazards

- Soil derived from Gila Conglomerate and Bisbee Group may contain clays that swell upon wetting
- Old earthen dams
- Soluble salts
- Area not in published floodplain
- Area not in mapped subsidence

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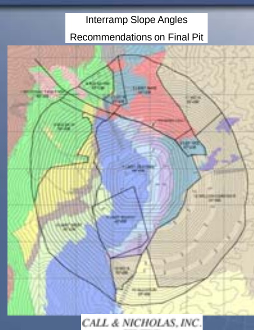
Pit Slope Stability

- Completed by Call and Nicholas, Inc. in February of 2008
- Slope angle recommendations for proposed open pit
  - Overall Factor of Safety = 1.2
  - Catch-bench reliability design = 80%
- Fragmentation estimate for crusher sizing



Questions

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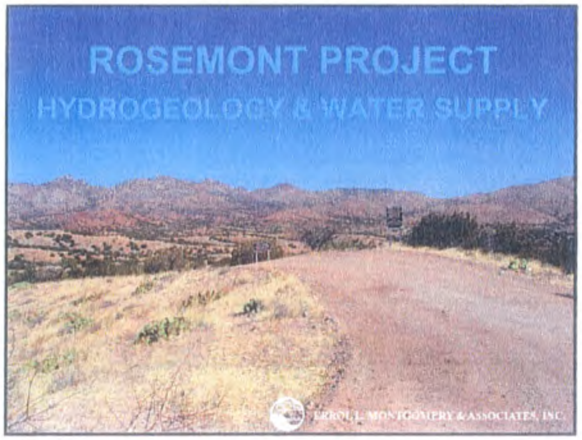
JAMES S. DAVIS, P.G.
Hydrogeologist

James S. Davis has more than 25 years of professional experience in hydrogeology and hydrology. Responsibilities have included: conducting and supervising field operations; preparation of technical reports for the evaluation and management of water resources in Arizona; and water law and regulation administration. Areas of specialization include: investigation of subsurface conditions at mining and hazardous waste sites, regional groundwater evaluation, water supply development, aquifer testing and analysis, assured and adequate water supply evaluation for land development, and water well design and construction supervision



PRESENTATION OUTLINE

- EAST SIDE - MINE AREA
  - HYDROGEOLOGY
    - Drilling & Testing Program
    - Groundwater & Spring/Seep Monitoring
  - GROUNDWATER FLOW MODELING
- WEST SIDE – SAHUARITA AREA
  - WATER SUPPLY PLAN
  - HYDROGEOLOGY
  - GROUNDWATER FLOW MODELING

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MINE AREA LAND CONTROL & OWNERSHIP

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PREVIOUS GROUNDWATER INVESTIGATIONS

- Hargis and Harshbarger (UA Study)
- Hargis and Montgomery (Monitoring)
- Montgomery & Associates (2007)

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MINE AREA WATER LEVELS

Well Symbols

- Pit Characterization Well
- Multi-Level Piezometer
- Deep Characterization Well
- Intermediate Characterization Well
- Shallow Characterization Well
- Alluvium Characterization Well
- Other Water Well
- Other Piezometer
- Spring or Seep
- Geotechnical Characterization Hole
- Mine Adit

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MINE AREA HYDROGEOLOGIC UNITS

- CONTINENTAL GRANODIORITE
  - Intrusive Mountain Core
  - Dense, consolidated
  - Limited fracturing
  - Very Low Permeability and Groundwater Storage
- PALEOZOIC CARBONATE ROCKS
  - Tilted to east, steeply-dipping
  - Broken-up, discontinuous blocks
  - Dense, but fractured and faulted
  - Groundwater flow and storage are fracture & fault controlled
  - Low permeability with locally moderate permeability along fractures and faults

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MINE AREA HYDROGEOLOGIC UNITS

- MESOZOIC (Cretaceous) ROCKS
  - Tilted to east, moderately-dipping
  - Dense, but fractured and faulted
  - Groundwater flow and storage are fracture & fault controlled
  - Low permeability with locally moderate permeability along fractures and faults
- CENOZOIC (Tertiary & Quaternary) BASIN-FILL DEPOSITS
  - Gently-dipping to flat-lying
  - Strongly cemented, esp. near mountains and mine
  - Strongly to moderately cemented elsewhere
  - Groundwater flow and storage are limited and not fracture-controlled
  - Low permeability with locally moderate permeability away from mountains

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HYDROGEOLOGIC UNITS

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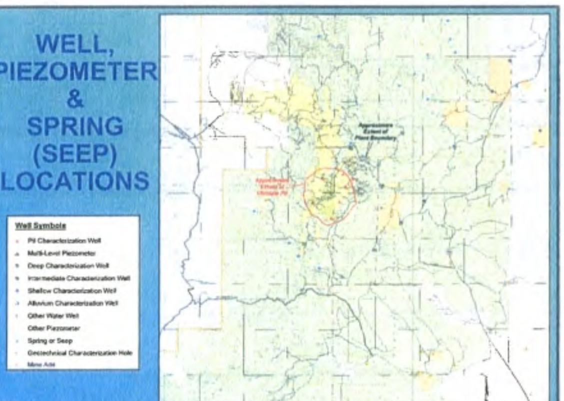
WELL, PIEZOMETER & SPRING (SEEP) LOCATIONS



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PHASE 1 DRILLING & TESTING

- Four wells constructed in pit area
  - (PC-1 through PC-4) during 2007
- Depths ranged from 1,020 to 1,503 feet
- Characterized chiefly Mesozoic units (Willow Canyon Formation)
- Low permeabilities, with locally moderate permeabilities along faults and/or dense fracturing
- Well yields ranged from 2 to 50+ gpm

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PHASE 2 DRILLING & TESTING

- Thirty wells and piezometers constructed in 2008
  - 18 on Rosemont lands
  - 12 on USFS lands
- Characterized most geologic formations
- Four additional wells constructed in pit area (PC-5 through PC-8, and three grouted multi-level piezometers (PZ-5, PZ-7, and PZ-8) adjacent to PC wells
  - Depths ranged from 2,000 to 2,200 feet
- Low permeabilities, with locally moderate permeabilities along faults and/or strong fracturing
- Well yields ranged from 20 to 45 gpm

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PHASE 2 DRILLING & TESTING (cont.)

- Eleven wells constructed in pairs outside but near pit area (HC wells)
- Depths ranged from 50 to 1,000 feet
- Characterized various geologic formations
- Low permeabilities
- Well yields ranged from <1 to 36 gpm; average 13 gpm

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PHASE 2 DRILLING & TESTING (cont.)

- Twelve wells constructed at distance from pit area (RP wells)
- Depths ranged from 30 to 600 feet
- Characterized various geologic formations
- Low permeabilities
- Well yields ranged from <1 to 33 gpm; average ~10 gpm

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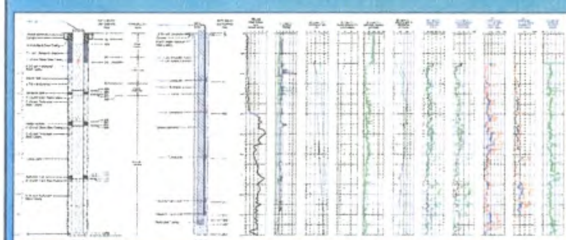
TYPICAL DIAGRAM OF PC & PZ WELLS



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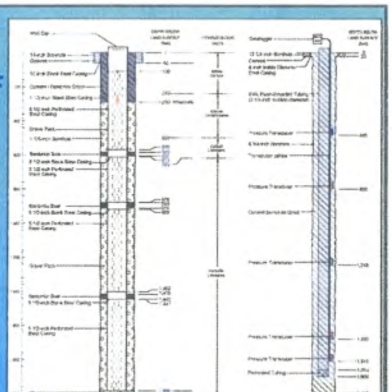
TYPICAL DIAGRAM OF PC & PZ WELLS

Wells PC-7 & PZ-7



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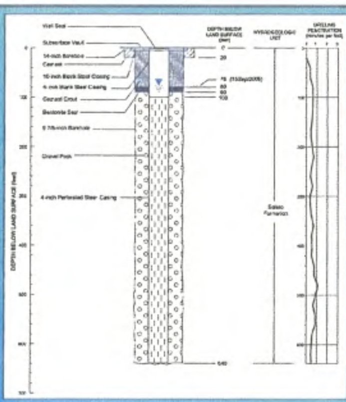
TYPICAL DIAGRAM OF HC WELLS

Well HC-4A



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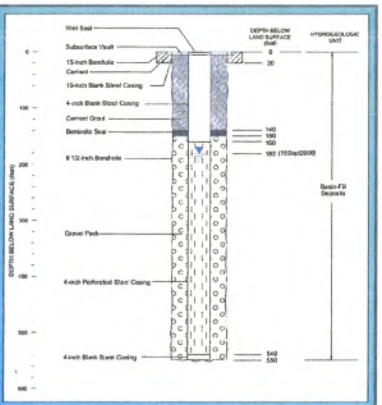
TYPICAL DIAGRAM OF RP WELLS

Well RP-4A



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PUMPING TESTS

- 24- and 12-hour zonal pumping tests at PC wells, with PZ multi-level piezometers and nearby wells as observation points
- 12-hour pumping tests at each HC and RP well, with adjacent and nearby wells as observation points
- 30-day pumping test planned using 4 wells in and near proposed pit; scheduled to begin in November

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AQUIFER PARAMETERS FROM SHORT-TERM TESTS

- Computed transmissivities ranged from <1 to 3,600 ft^2/day
- Highly variable
- Fracture/fault controlled
- Computed storage coefficients generally in range of 10^{-4} to 10^{-5}
- The long-term, multi-well pumping test should refine ranges and provide data to determine aquifer response to dewatering

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GROUNDWATER MONITORING PROGRAM

- From July 2006-March 2008, water levels measured periodically in existing wells
- Since March 2008
  - Water levels in wells measured and spring flow monitored monthly
  - Many wells equipped with continuous water level recording devices
  - Water quality sampling at wells and springs

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MINE AREA WATER LEVELS

Well Symbols

- Pit Characterization Well
- Multi-Level Piezometer
- Deep Characterization Well
- Intermediate Characterization Well
- Shallow Characterization Well
- Alluvium Characterization Well
- Other Water Well
- Other Piezometer
- Spring or Seep
- Geotechnical Characterization Hole
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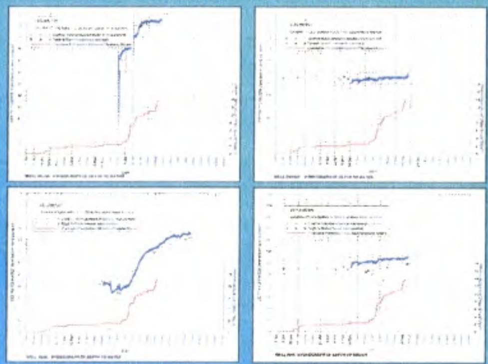
GROUNDWATER LEVEL TRENDS



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GROUNDWATER QUALITY

- Groundwater and spring samples analyzed for common and trace inorganic constituents, radiochemical constituents & parameters, organic compounds, and stable isotopes
- Groundwater quality good to excellent, with very few AWQS or MCL constituents exceeded
- TDS ranged from 190 - 1,480 mg/L
- Average TDS = 430 mg/L
- pH ranged from 6.9 to 7.9
- Average pH = 7.5

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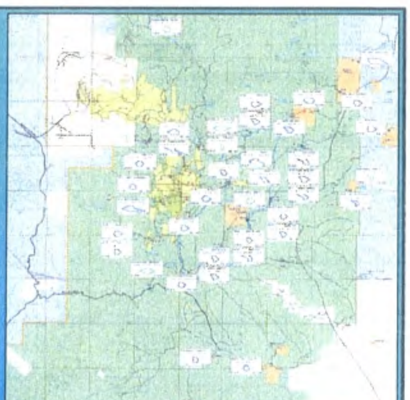
GROUND-WATER QUALITY



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SPRINGS & SEEPS

- Seeps and springs nearest mine monitored periodically since November 2006
- Larger number of seeps and springs monitored monthly since January 2008
- 20 springs presently being monitored
- Monitoring conditions and flow monthly
- Obtaining samples quarterly where practical

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SPRINGS & SEEPS

- Of 20 springs/seeps being monitored:
  - Most are dry or moist spots on ground, with observable flow only during or shortly after storms
  - Four springs have sustained flow
    - Rosemont Spring (~0.1 to 0.5 gpm)
    - MC-2 (McCleary Canyon) (~0.1 gpm)
    - Deering Spring (~0.1 gpm)
    - Questa Spring (~0.1 gpm)

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MARK J. THOMASSON
Hydrogeologist, Modeler

Mark Thomasson has more than 7 years of professional experience in hydrogeology and hydrogeologic research. After completing his Doctorate in Hydrology, he conducted postdoctoral research at the University of Arizona (2001), characterizing flow and transport through the deep unsaturated zone at the field scale. Dr. Thomasson subsequently took a position as Assistant Professor of Hydrogeology at the University of North Carolina at Charlotte (2002 – 2006). Since joining M&A in 2006, he has focused his attention on developing analytical approaches and field data collection methods to characterize hydrogeologically complex saturated and unsaturated systems, developing inverse procedures to estimate hydraulic properties of aquifers, and developing and operating numerical groundwater flow models for simulation of local and regional aquifer responses. Dr. Thomasson is knowledgeable in a wide variety of numerical groundwater modeling codes, including: HYDROGEOCHEM/LEHGC, NETPATH, WATEQ4F, HYDROFLOW, HYDRUS 1-D/2-D, VS2D, FEHM, MODFLOW, FEMWATER, RT3D, UTCHEM, FEFLOW, SEEP/W, FEFLOW, MODFLOW-SURFACT.

ROSEMONT PROJECT
HYDROGEOLOGY & WATER SUPPLY

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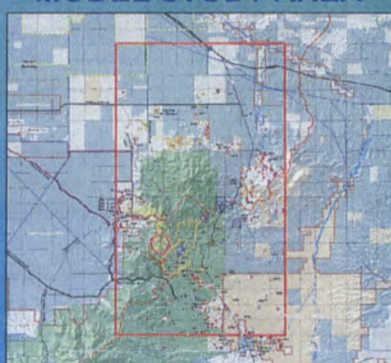
MODEL STUDY AREA



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GROUNDWATER FLOW MODEL

- Data Compilation and Evaluation
  - Geologic framework
  - Regional geologic framework – Previous investigations
  - Hydrogeologic data from drilling/testing programs
  - Water level and water quality data from monitoring program
  - Meteorological data from Rosemont and other weather stations
  - Data from existing wells
    - Historic water levels
    - Drillers' logs
    - Water quality data
    - Well performance data

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GROUNDWATER FLOW MODEL

- Conceptual Model Discussion
  - Groundwater Recharge and Discharge
  - Hydrogeologic Flow System
  - Preliminary Assumptions

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GROUNDWATER FLOW MODEL

- Numerical Model Development (Ongoing)
  - Model Software
  - Model Construction
    - Grid
    - Extent
    - Aquifer Parameters
    - Groundwater Recharge
    - Etc.

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GROUNDWATER FLOW MODEL

- Numerical Model Development
  - Model Calibration
  - Model Projections
    - Quantification of Pit Dewatering Requirements
    - Impacts to Local Groundwater Levels
    - Impacts to Regional Groundwater Levels
    - Evaluation of Pit Lake Presence and Fate
  - Model Sensitivity Analyses

ERROL L. MONTGOMERY & ASSOCIATES, INC.

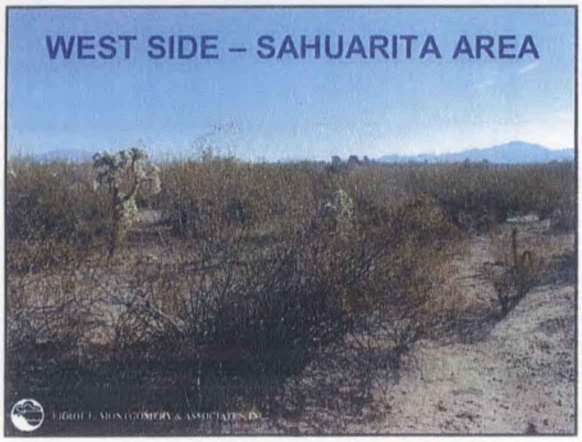
MARK H. MYERS

Senior Consultant, Water Resource Policy & Economics

Mark Myers has broad expertise in balancing the policy concerns and economic considerations involved in the integrated management of real property, natural resources and water rights. He has more than 25 years experience with structuring complex, multi-party transactions and with the planning and implementation of multiple use projects. He has worked extensively with private, non-profit and public entities. Mr. Myers has a special interest in projects and policy issues that require balancing economic development needs and sensitive environmental concerns. He also has particular expertise in developing the institutional framework and management structure for multiple participant, multiple purpose projects that cross established jurisdictional boundaries.

JULIET M. McKENNA, P.G.
Hydrogeologist, Water Policy Consultant

Juliet McKenna has more than 10 years of experience in hydrogeology and water policy consulting. She joined M&A in early 2007, bringing technical capabilities to the company's hydrogeology practice, as well as to the new water policy and economics service area. Juliet's work has focused on developing sustainable groundwater supplies for municipal agencies, public water companies, and private entities in the western United States and New England area. She has been involved in a diverse range of groundwater investigations, including water supply feasibility assessments, aquifer tests in fractured bedrock systems, groundwater withdrawal permitting, production well design and installation, state and federal drinking water regulation compliance, and environmental site investigations. In addition to her experience in groundwater consulting, Juliet previously served as the director of a water management coalition in the Palouse region of the inland Northwest, where her responsibilities included public outreach to disseminate information on declining water levels in the regional aquifer and water conservation measures to help reverse these trends.



WATER SUPPLY PLAN

- Groundwater Withdrawal Permit obtained from ADWR under A.R.S. 45-414
  - Mineral Extraction & Metallurgical Processing
- Recharge of CAP

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WATER SUPPLY PLAN

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WATER SUPPLY PLAN

- Water Delivery System
  - Water supply wells
  - 17 mile pipeline (24") to mine site
  - Boosters
  - Design Capacity
  - Right of Ways / Easements

WATER SUPPLY PLAN

- Local Well Owner Protection Program
  - Discussions with United Sahuarita Well Owners
  - Established 11 sites for Groundwater Level and Quality Monitoring

WEST SIDE MONITORING PROGRAM

WEST SIDE MONITORING PROGRAM

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WEST SIDE GROUNDWATER WELLS

- Wells in study area produce from a few to more than 2,000 gpm
- Domestic wells in Sahuarita Heights generally produce a few to 35 gpm
- Approximately 300 domestic wells in Sahuarita Heights area
- Well database

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WEST SIDE HYDROGEOLOGY

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ROSEMONT TEST WELLS

- Two wells constructed to depths of 1,211 and 1,300 feet
- Characterized basin-fill sediments and groundwater quality
- Transmissivity ranged from 1,340 to 2,680 ft^2/day
- Anticipated well production 500 to 1,500 gpm
- Excellent groundwater quality – TDS range 210 – 340 mg/L

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WEST SIDE HYDROGEOLOGY

- Groundwater occurs in basin-fill deposits
- Hydrogeologic Units
  - Ft. Lowell Formation (dry in Sahuarita Heights)
  - Tinaja beds (principal aquifer)
- Silty sand with minor gravelly zones
- Depth to water 200 to 250 feet
  - Substantially deeper during irrigation season
- Groundwater flow toward northwest
- Water level trends over time

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WEST SIDE HYDROGEOLOGY

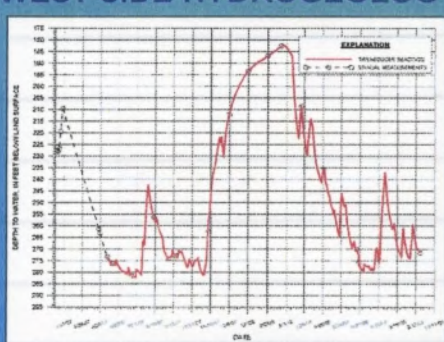

FIGURE 1. GROUNDWATER LEVEL HYDROGRAPH FOR EXPLORATION WELL E-1

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WEST SIDE HYDROGEOLOGY

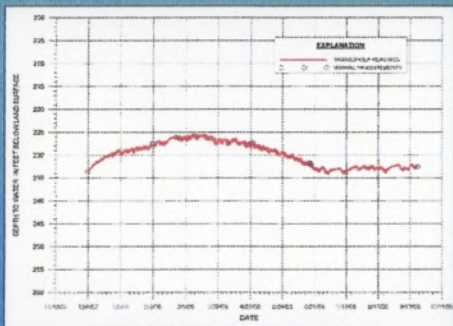

FIGURE 1. GROUNDWATER LEVEL HYDROGRAPH FOR EXPLORATION WELL RC-2

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WEST SIDE GROUNDWATER FLOW MODEL

- Began with ADWR Tucson AMA Groundwater Model
  - Numerical Basin-Wide Model
  - Modflow Software
  - Updates Provided by ADWR
- Model Challenges

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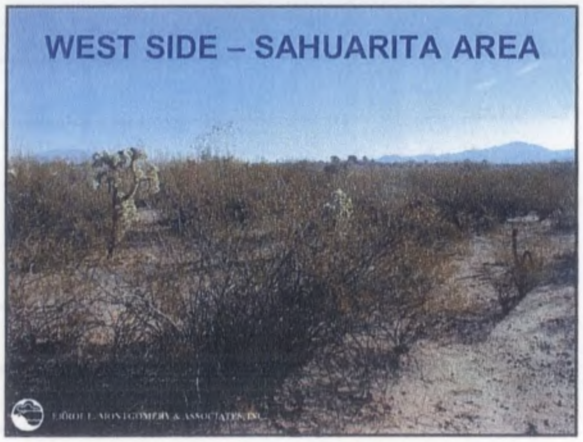
HALE W. BARTER
Modeling Coordinator

Hale Barter has almost 20 years of professional experience in hydrogeology and environmental assessment. He provides leadership for the firm's modeling practice, and has developed and supervised implementation of numerous models for a wide-range of applications. Mr. Barter has experience with numerical models, including MODFLOW, MODFLOW-SURFACT, SWIFT, MT3D, UNSATII, MODXX, with proprietary finite-element models, including PATH3D and MODPATH, and with analytical codes, including CSUPAW, MOUNDHT, and QuickFlow.



WEST SIDE GROUNDWATER FLOW MODEL

- Refinement of Model Following Data Evaluation
  - Aquifer Parameters from Drilling & Testing
  - Update Groundwater Pumpage
  - Evaluate & Modify Groundwater Recharge
  - Santa Cruz Recharge

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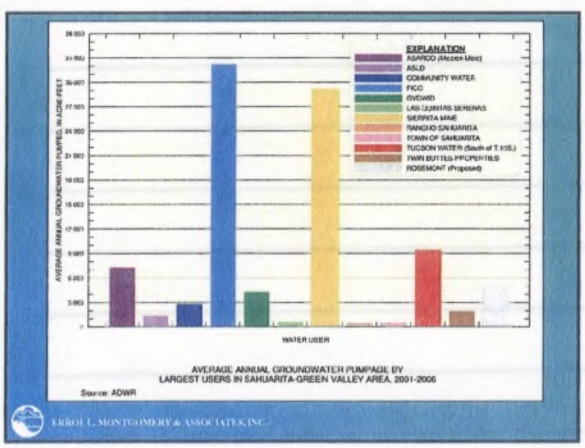

WEST SIDE GROUNDWATER FLOW MODEL

- Results of Model Calibration
  - Overall match in study area
  - Match in Sahuarita Heights area

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LOCATIONS OF CALIBRATION HYDROGRAPHS

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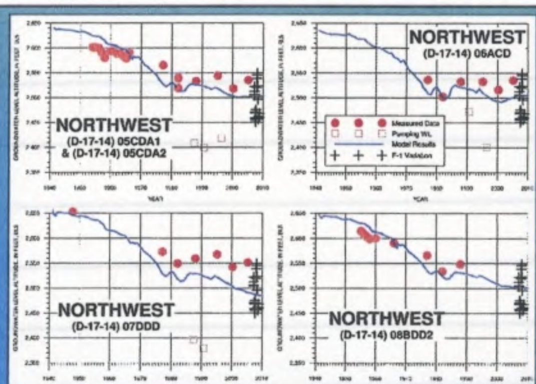

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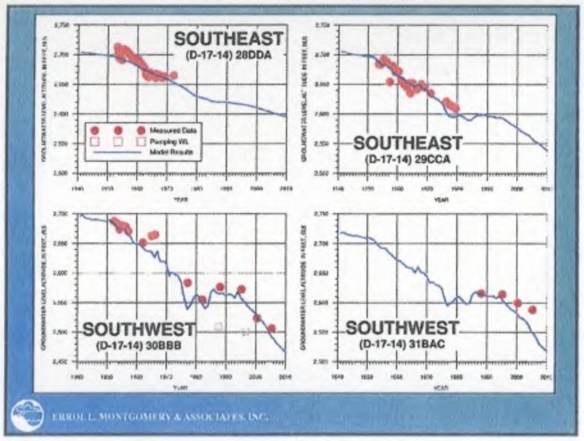

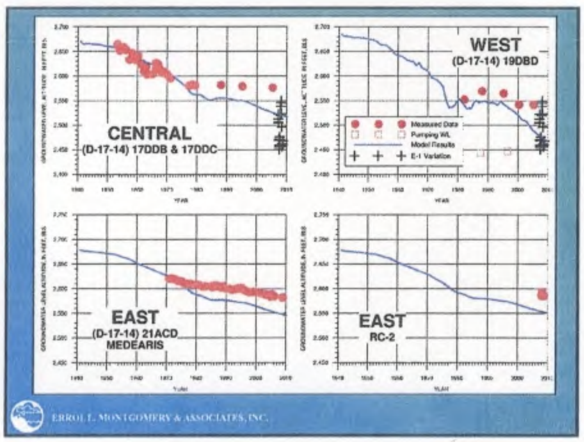

WEST SIDE GROUNDWATER FLOW MODEL

- Rosemont Water Supply Simulations
  - Rosemont Pumping 105 AF/year for 20 years
  - Pumpage by Other Groundwater Users
  - Recharge at USFs and WWTPs
  - Model Results (Pending)
    - Impacts to Regional Groundwater Levels
    - Impacts to Local Domestic Wells
  - Local-Scale Model Evaluation

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TETRA TECH

Mark Williamson, PhD

Senior Geochemist

Dr. Williamson is an environmental geochemist with 24 years of experience in consulting, basic/applied research, and educational settings. He has been involved in geochemical studies and site evaluations across the United States involving field, laboratory, and computational components. Dr. Williamson works with both natural and engineered systems. He has been and remains engaged with projects in support of industrial, academic, and educational efforts that seek to develop and apply geochemical knowledge and techniques. He routinely provides support and guidance for geochemical studies and programs aimed at protection of water resources, including quantification of geochemical processes for engineering design, impact analysis, and interpretation. His background includes extensive work with acid mine drainage, metals in aquatic environments, geochemical engineering, and the fate and transport of chemicals in the environment.

TETRA TECH

Mine Rock Geochemistry and Pit Lake Model

For the Rosemont Copper Project

ROSEMONT COPPER
Resourceful.

By Mark Williamson, PhD

Presentation Topics

- Approach to characterization of mine rock (for pit walls as well as waste disposal facilities) and summary results
- Tailings characterization
- The conceptual pit lake hydrochemical model
- Overview of components of pit lake model
- The Dynamic Systems Model (DSM)

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Mine Rock Characterization

Test Protocol	Purpose
Acid-Base Accounting (ABA)	Evaluate relative proportions of potentially acid generation and acid-consumption capacity.
Humidity Cell Testing (HCT)	Accelerated weathering test for samples showing potential or unclear capacity to generate acidity.
Synthetic Precipitation Leaching Procedure (SPLP)	Arizona-required laboratory leaching test on powdered material using weak acid solution.
Meteoric Water Mobility Procedure (MWMP)	Laboratory leaching test on coarse/run-of-mine rock using plain water

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Summary of Mine Rock Tests

Rock Type	Anticipated Tonnage	Percent of Waste	ABA	Whole Rock	SPLP	MWMP
Arkose	620,630,000	49%	57	23	8	8
Limestone Conglomerate	119,448,000	9%	11	2	1	1
Abrigo	102,460,000	8%	5	1	5	0
Overburden	91,620,000	7%	7	4	3	2
Horquilla	77,091,000	6%	19	3	8	3
Andesite	73,671,000	6%	35	12	4	5
Martin	39,084,000	3%	8	2	4	0
Bolsa	34,661,000	3%	13	1	6	0
Earp	27,680,000	2%	13	5	6	0
Epitaph	26,914,000	2%	14	1	5	0
Escabrosa	24,776,000	2%	9	3	4	0
Colina	22,200,000	2%	8	3	4	0
Qmp	14,555,000	1%	9	4	2	1
Totals	**1,274,790,000**	**100%**	**208**	**64**	**60**	**20**

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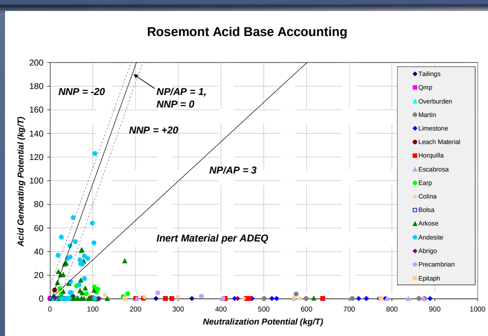
Acid-Base Accounting



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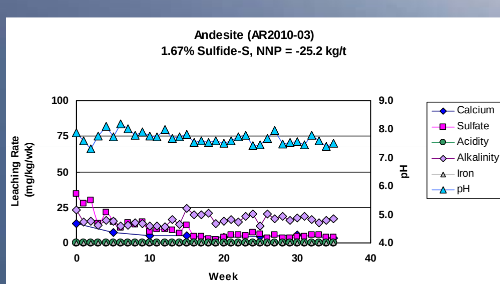
Humidity Cell Testing (Andesite)



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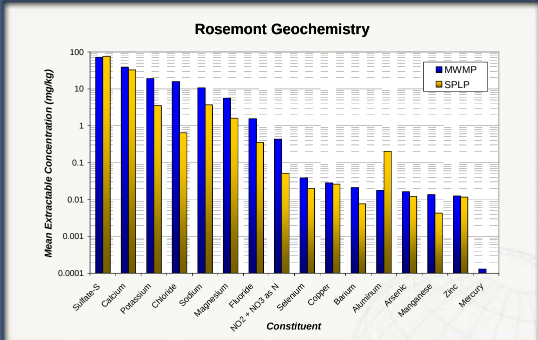
SPLP vs MWMP



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Presentation Topics

- Approach to characterization of mine rock and summary results
- **Tailings characterization**
- The conceptual pit lake hydrochemical model
- Overview of components of pit lake model
- The Dynamic Systems Model (DSM)

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Tailings Characterization

Sample Date	Current Testing Status	ABA	NAG	Whole Rock	SPLP	MWMT	Kinetic
May 2006	Completed	X	X	X	X		
February 2007	Completed	X	X	X			X
June 2007	Completed	X	X	X	X	X	
July 2008	In Progress	X		X	X	X	X

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Tailings Characterization

- Net acid consuming material
- High pH/generally low TDS humidity cell effluent
  - *Recent sample relatively high TDS*
- Low trace metals in SPLP, MWMT and HCT

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Presentation Topics

- Approach to characterization of mine rock and summary results
- The conceptual pit lake hydrochemical model
- Overview of components of pit lake model
- The Dynamic Systems Model (DSM)

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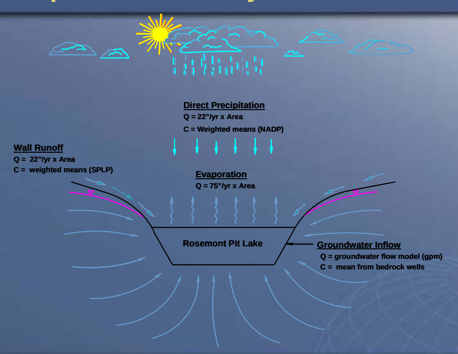
Conceptual Pit Lake Hydrochemical Model



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Conceptual Pit Lake Model

$$\sum_{i=1}^{n} Q_i C_i$$

- Sum of flows and concentration
- Monthly time steps
- Geochemical equilibration
- Probabilistic simulation

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Presentation Topics

- Approach to characterization of mine rock and summary results
- The conceptual pit lake hydrochemical model
- Overview of components of pit lake model
- The Dynamic Systems Model (DSM)

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Hydrologic Components

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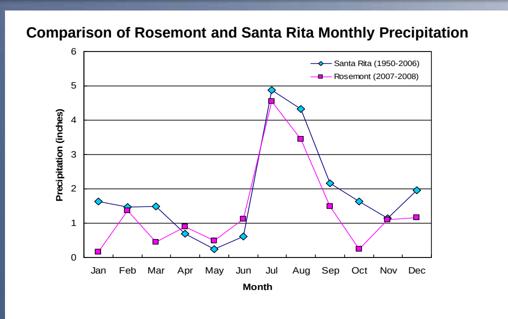
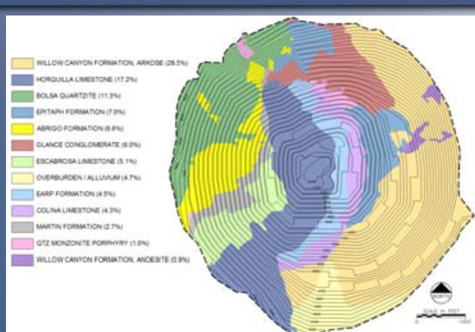
Groundwater Inflow

- Principal hydrologic component
- Important considerations:
  - Terminal vs. “flow-through”
  - Rates of infilling
- Groundwater model currently under development

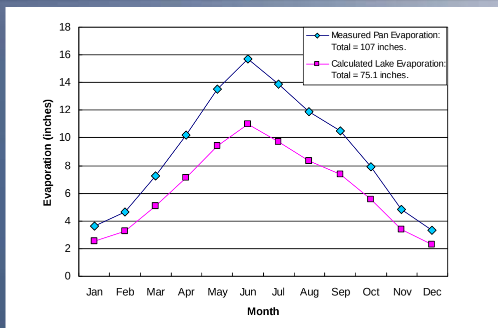
Direct Precipitation



Pit Wall Runoff



Evaporation



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Geochemical Components

- Groundwater Flow
- Direct Precipitation
- Pit Wall Runoff

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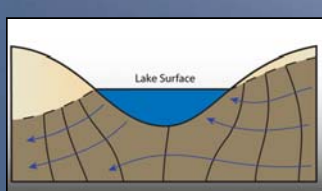
Groundwater Inflow Chemistry

- Typically the largest potential contributor of chemical mass
- Requires characterization of local groundwater



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Precipitation Chemistry

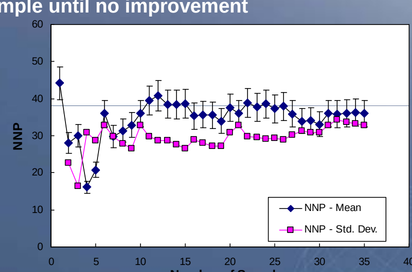
National Atmospheric Deposition Program (NADP)

Pit Wall Runoff

- Derived from mine rock characterization
  - *Representative Sampling*
  - *Chemical loading parameters*
  - *Outcrop areas*

Representative Sampling

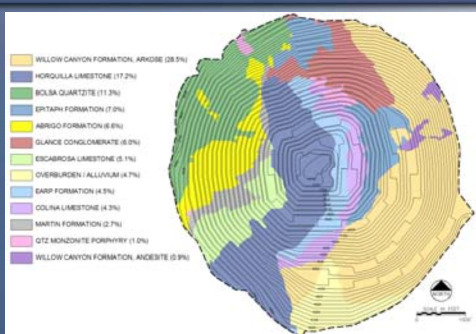
- How many is enough?
- Sample until no improvement



Chemical Loading Parameters

- SPLP data used as source concentration for pit wall outcrops
- SPLP, long-term HCT water composition and MWMP produce consistent results
- Due to general lack of sulfide mineralization, water composition more closely tied to equilibrium than kinetic concerns

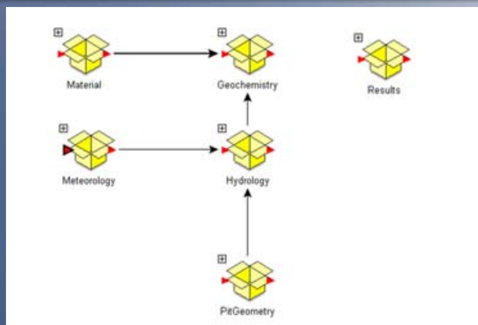
Areas of Exposed Rock Types



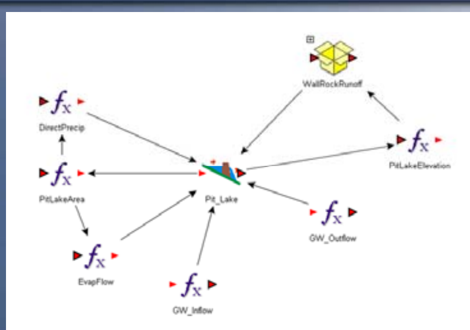
Dynamic Systems Model (DSM)

- GoldSim
- Graphical User Interface
- One time data and formula entry
- Probabilistic ability
  - *Range of possibilities as a result of parameter uncertainty*
  - *Probability of occurrence*

Rosemont Pit Lake DSM



Hydrology Module



Summary and Status

- Mine rock is, on total mass basis, acid-consuming
- Representative samples of principal lithologies outcropping pit complete
- Geochemical characterization of pit wall lithologies complete
- DSM largely complete, dependant upon completion of hydrologic evaluation
- No useful DSM runs to date

Questions

Mark Williamson, PhD
mark.williamson@tetratech.com
970.223.9600

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TETRA TECH

Kristie Kilgore

Kristie Kilgore is a senior project manager with Tucson-based consulting firm Engineering and Environmental Consultants (EEC), and leads the regulatory services program for the Tucson office of EEC. Ms.Kilgore has a BS in geology, and more than 23 years of experience in the environmental field, focusing in the areas of regulatory compliance, hydrogeology, project management, and community outreach. Prior to joining EEC she was a Senior Hydrologist/Advisor in the Groundwater Section of the Arizona Department of Environmental Quality. In that role she reviewed Aquifer Protection Permits for the Section Manager as part of quality control to improve technical consistency. She also developed and managed the expedited Aquifer Protection permitting program on behalf of ADEQ and managed contractor teams who reviewed permit applications, negotiated with applicants, and prepared permits for agency issuance in 6 months or less.

Aquifer Protection Permitting: Rosemont Mine

Pima County, Arizona

Kristie Kilgore, Sr. Project Manager
Engineering and Environmental Consultants (EEC)

Engineering and Environmental Consultants Inc.

Aquifer Protection Permit Introduction: What is it and what does it do?

- Arizona-specific program
- Protects groundwater for current and future drinking water use
- No further degradation
- Regulates “discharging facilities” at mine as defined by statute
- *Prevents* contamination by requiring use of control technology (BADCT)

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5 Demonstrations to Obtain an APP

- Zoning
- Technical Capability
- Financial Capability
- Best Available Demonstrated Control Technology (BADCT)
- Compliance with Aquifer Water Quality Standards (AWQS) at the Point of Compliance (POC)

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The APP Process: Agency Steps

- Administrative Completeness Review (ACR)
- Substantive (Technical) Review (SCR)
- Public Participation
  - Public Notice and 30-day comment period
  - Public Hearing
- Permit Issuance or Denial
- Performed Under Licensing Time Frames

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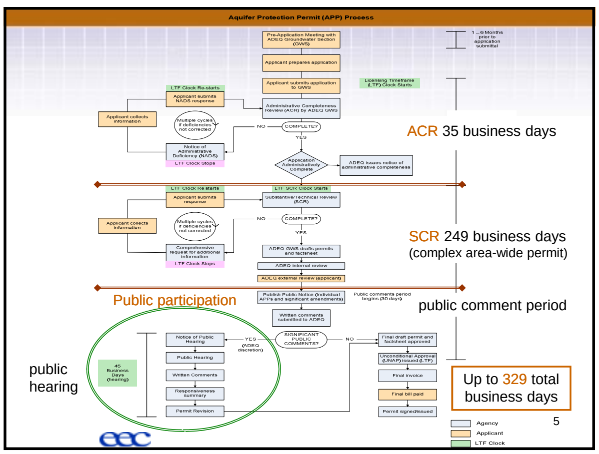

Types of APP-regulated Facilities

- Generally permitted facilities
  - intermediate stockpiles
  - domestic wastewater treatment facility
- Categorical facilities by statute
  - Dry stack tailings piles
  - Lined heap leach
  - Surface impoundments (PLS, Raffinate, PWTS)
  - Waste rock dump
  - Solid waste disposal area

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Main APP Regulated Facilities

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BADCT: what is it & how does it apply?

- Prevents contamination
- Control technology/design
- Engineering practices and procedures
- Water conservation and reclamation
- For new facility – requires State of the Art/Industry Standard design
- Includes stormwater controls

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Innovative BADCT at Rosemont

- Dry Stack Tailings Method
  - better than current accepted BADCT for permitted mines
  - Reduces tailings moisture content from ~60% to 15%
  - Reduces potential for infiltration
- Double-Lined Heap Leach Pad
  - prescriptive
- Double Lined Raffinate and PLS Ponds w/Leak Detection
- Lined Storm-water Ponds
- Lined Reclaimed Water Pond

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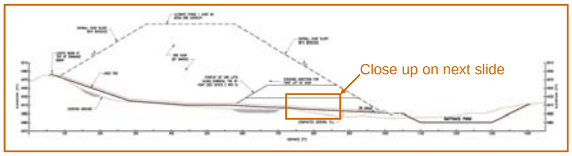
Heap Leach and Raffinate Pond: Side View



Slide not to scale

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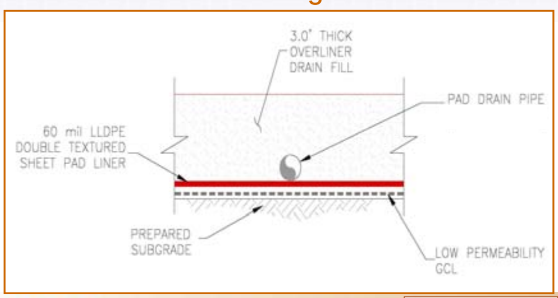
Heap Leach Double Liner: Cross-Section of Design



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What does compliance with AWQS mean?

- Aquifer Water Quality Standards ~ drinking water maximum contaminant levels (MCLs)
- Protection of off-site groundwater uses
- If ambient groundwater quality > AWQS, no further degradation

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What are the steps in the AWQS demonstration?

- Collect pre-operation ambient groundwater quality data (baseline)
- Set Alert Levels (ALs) and Aquifer Quality Limits (AQLs) in permit with AWQS and baseline data
- Designate Point of Compliance locations where comparisons are made
- On-going comparison of groundwater quality to permit limits (~re-demonstration)
- Monitoring to verify BADCT performance - prevent off-site impact

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Rosemont Approach

- Pre-start up
  - Collect Baseline/Ambient Groundwater Data (in process)
- After Permit Issuance
  - Install Permanent Monitor Wells at POCs
  - Amend Permit to Set ALs and AQLs
- After Start-up
  - Perform Routine Monitoring in Wells at the designated Point of Compliance (POCs)

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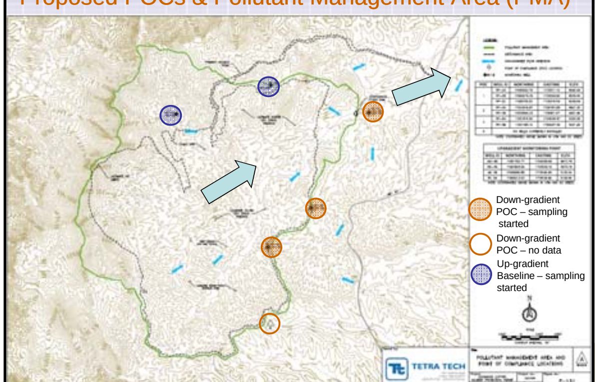
Proposed POCs & Pollutant Management Area (PMA)



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Overview of Ambient Groundwater Data/Baseline

- Goal – Submit 2 to 3 rounds of ambient groundwater data in application
  - Up-gradient locations
  - 3 out of 4 proposed POC locations
- 12 rounds of samples per POC well prior to mine start-up
- Establish ALs and AQLs after application submittal but before mine startup

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Licensing Time Frames

- What is LTF?
  - Application = contract with state
  - Terms of contract for processing defined in rule
- How does LTF drive agency interactions?
  - Opportunities to “stop the clock” to request missing information
  - Burden on applicant to supply missing data in timely manner
  - Timeline is dependent on response time

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APP Closure Requirements

- Closure strategy with submittal
- Financial demonstration includes closure cost based on closure strategy
- Financial mechanism to guarantee funds for closure (trust, bond, etc.)
- Rosemont Goal - No further discharge at time of closure
- Clean-close as much of facility as possible

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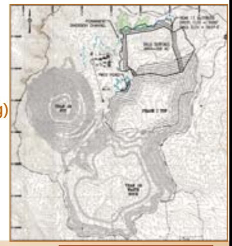
Timeline Goals

- Submit Application ~
  - November/December '08
- ACR Completeness
  - Complete at time of submittal
- Public Notice
  - August 2009
    (time for public participation with hearing)
- Permit Issuance Goal
  - January 2010



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Questions & Answers

eec Engineering and Environmental Consultants, Inc.
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David Moll
Project Manager

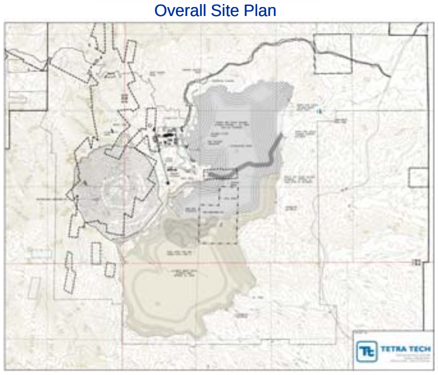
Master of Business Administration, University of Michigan, 1984
Certificate of Advanced Study, American Graduate School of International Management,
BS Civil Engineering, Iowa State University, 1971

David Moll is a project management professional experienced in engineering and construction management. David's key strengths include ability to make timely decisions, act with integrity, focus on achieving results, and learn from experiences to achieve continuous improvement. He uses strong technical and managerial background, project management skills, and a strong ability to integrate diverse activities to ensure his projects achieve project goals involving cost, schedule, quality of deliverable and/or performance.

Facilities Engineering Presentation

M3 Engineering & Technology Corporation

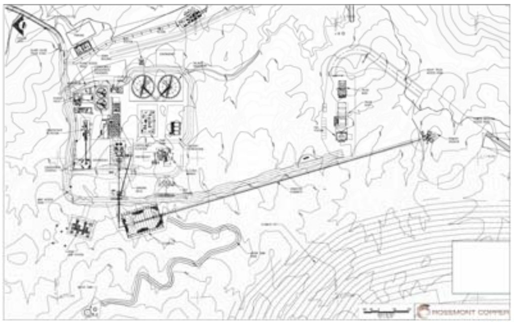
Overall Site Plan



Facilities Engineering Scope of Work

- Process Facilities
- Ancillary Facilities
- Civil Infrastructure
- Power Supply
- Fresh Water Supply & Distribution

Facilities Plan



Process Facilities

- Sulfide Processing Plant
  - 75,000 DSTPD of Sulfide Ore
  - 1,350 DSTPD of Copper Concentrate
  - 15 DSTPD of Molybdenite Concentrate
- Sulfide Circuit
  - Primary Gyratory Crusher, Overland Conveyor, Stockpile
  - SAG Mill & 2 Parallel Ball Mill Circuits
  - Copper Flotation with Molybdenum Separation Circuit
  - Concentrate Dewatering / Filtration
  - Flotation Tailing dewatering, filtration, convey.
  - Dry Stack Tailing Area
  - Reagent Area

Process Facilities

- Oxide Facility
  - 17,000 DSTPD of Oxide Ore by Leach
  - Approx. 76,800 Pounds Per Day High Purity Cathode Copper
- Oxide Circuit
  - Leach Pad for Run of Mine Ore
  - Raffinate and PLS Ponds
  - Storm Water Pond
  - Two Extraction and Ore Stripper Solved Extraction Circuit
  - Electro-winning Facility
  - Reagent Area

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Ancillary Facilities (Support Process & Mine)

- Warehouse Facilities
- Administration Building
- Change Room
- Analytical Laboratory
- Mine Truck Shop with Tire Shop
- Mine Truck Wash and Lubrication Facility
- Gasoline & Diesel Fuel Storage & Dispensing Facilities
- Ammonium Nitrate Silos and Explosives Magazines
- Guard Facility with Truck Scale

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Civil Infrastructure

- Modifications to State Route 83 at Intersection with Mine East Access Road
- East Access Road
- Upgrades to approx. 4.8 miles USFS roads and private roads
- New USFS connecting roads around Plant approx. 5.6 miles
- Perimeter Road around Waste Rock & Dry Stack Tailing Facility
- Overall Site Grading and Drainage
- In-plant Roads
- Initial Mine Haul Roads

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Civil Infrastructure

- North Storm Water Diversion Structure
- Storm Water Diversion to Process Water Temporary Storage (PWTS)
- Storm Water Diversions around Open Pit
- Dry Stack Tailing Facility under drain
- Compliance – Point Water Management Structure

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Power Supply and Distribution

- Connection to existing Tucson Electric Power (TEP)
- Upgraded 138 KV line by (TEP)
- New 11.6 mile 138 KV line to Rosemont Main Substation
- Substation at TEP connection to step down voltage for Fresh Water System
- Rosemont Substation (138 KV to 34.5 KV)
- Distribution to Process Motor Control Rooms and other Facilities

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Resourceful.

Fresh Water Supply and Distribution

- Well field
- 20 inch Water Delivery Line with Booster Stations
- Fresh Water and Fire Water Tank at Process Facilities
- Potable Water System with Water Treatment Package
- Fresh Water System
- Process Water System
- Fire Water System
- Pit Dewatering System

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M3 EPCM Scope of Work

- Project Management
- Basic Engineering
- Detail Engineering
- Procurement
- Construction Management
- Commissioning
- Start-Up Assistance

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EPCM Status

- Currently in Basic Engineering Phase
- Started in May 2008, finish in April 2009
- Basic Engineering Effort
  - Update Deliverables with Better Scope Delineation
  - Improve Quality of Information for update of Capital Estimate and Operating Estimate
  - Finalize Criteria for Detailed Design Effort
- Effort Currently Supported by Other Consultants:
  - Geotechnical Services — Tetra Tech
  - Geotechnical Drilling Contract — Tetra Tech
  - Dry Stack Tailings Facility — AMEC
  - Heap Leach Facility — Tetra Tech

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Basic Engineering Deliverables

- Project Procedures
- Drawing, Specification, and Equipment Lists
- Discipline Design Criteria
- Major Equipment and Material Specifications
- Flowsheets
- General Arrangement Drawings
- P&IDs
- Electrical One-Lines
- Civil Site Plan and Rough Grading Drawings
- Architectural Drawings
- Major Concrete Foundation Drawings (Mills)
- Updated Capital Estimate and Operating Estimate
- EPCM Schedule

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Detail Engineering Phase

- Planned start in February 2009
- Engineering effort linked to forecasted availability of vendor information
- Substantial Complete in July 2010
- Engineering support will continue through construction

Derek T. Wittwer, P.E.
Associate Engineer

Derek has 15 years of professional experience primarily related to the mining industry. He has been involved with all facets of projects including civil/geotechnical engineering and design, hydrologic/hydraulic engineering and design, geotechnical site investigations, and construction oversight. His experience related to mining projects includes a wide range of project types including the design of rockfill, earthfill, and cycloned tailings storage facilities. His cost efficient and innovative project management skills have proven successful on both small and large-scale projects.

John F. Lupo, Ph.D., P.E.
Principal Engineer

John has 22 years of engineering experience, with a focus on geotechnical issues and design of facilities associated with the mining industry. His experience with tailings facilities includes permitting, geotechnical site investigations, surface water diversion design, water balance, facility design and closure, tailings consolidation and seepage control, and liquefaction assessments. He has been involved in design and construction of tailings and heap leach facilities for the copper, gold, silver, nickel, and uranium industries. He has designed and constructed facilities for high altitude mines with high snowfall and limited construction seasons.

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Dry Stack Tailings Storage Facility

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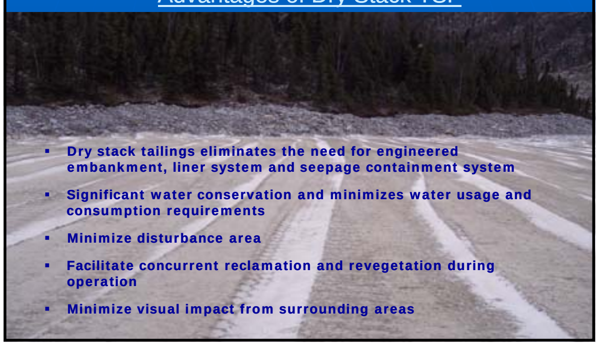
Advantages of Dry Stack TSF



- Dry stack tailings eliminates the need for engineered embankment, liner system and seepage containment system
- Significant water conservation and minimizes water usage and consumption requirements
- Minimize disturbance area
- Facilitate concurrent reclamation and revegetation during operation
- Minimize visual impact from surrounding areas

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Dry Stack TSF Design Criteria

- Production rate = 75,000 tpd (tons per day) or 27 MT per annum
- Storage capacity estimated at 587 MT and mine life estimated at approximately 20 years
- Average tailings in-place dry density = 109 pcf (pounds per cubic foot)
- Compliance with all applicable regulations including the Arizona Best Available Demonstrated Control Technology (BADCT) standards
- 50-foot lifts with final bench width of 25 feet per lift
- Overburden rock buttress at 3:1 side slopes, 3.5:1 overall slopes
- TSF will be constructed in two phases (North and South Stack)
- Implement dust control suppression measures throughout the production period
- Concurrent reclamation during operations to promote establishment of revegetation

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Phase I Dry Stack TSF Characteristics

- Approximately 12 years production period
- Crest elevation = 5250'
- Tailings surface elevation = 5237.5'
- Total capacity = 332 million tons (MT)
- 50-foot lifts with final bench width of 25 feet per lift
- 3:1 side slope per lift
- 3.5:1 Overall side slope
- Total footprint area of 706 Acres
- Footprint outside of McCleary Canyon

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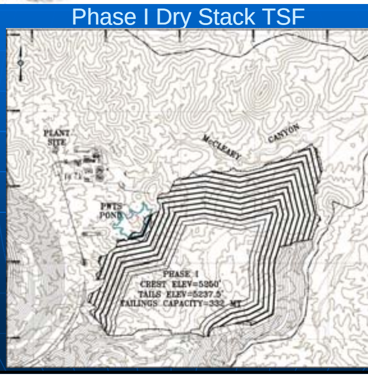
Phase I Dry Stack TSF



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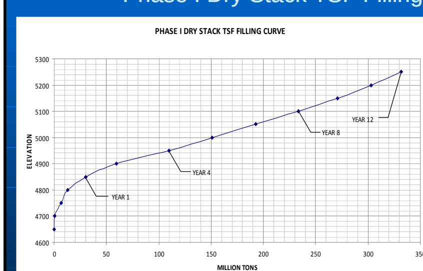
Phase I Dry Stack TSF Filling Curve



	Elev	Tails Volume per Lift (cy)	Total Tails Volume (cy)	Total Tailings Vol (MT)	YR
PHASE I	4650	[illegible]	[illegible]	[illegible]	[illegible]
	4700	[illegible]	[illegible]	[illegible]	[illegible]
	4750	[illegible]	[illegible]	[illegible]	[illegible]
	4800	[illegible]	[illegible]	[illegible]	[illegible]
	4850	[illegible]	[illegible]	[illegible]	[illegible]
	4900	[illegible]	[illegible]	[illegible]	[illegible]
	4950	[illegible]	[illegible]	[illegible]	[illegible]
	5000	[illegible]	[illegible]	[illegible]	[illegible]
	5050	[illegible]	[illegible]	[illegible]	[illegible]
	5100	[illegible]	[illegible]	[illegible]	[illegible]
	5150	[illegible]	[illegible]	[illegible]	[illegible]
	5200	[illegible]	[illegible]	[illegible]	[illegible]
	5250	[illegible]	[illegible]	[illegible]	[illegible]

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Phase II Dry Stack TSF Characteristics

- Approximately 8 years production period
- Crest elevation = 5250′
- Tailings surface elevation = 5237.5′
- Total capacity = 255 million tons (MT)
- 50-foot lifts with final bench width of 25 feet per lift
- 3:1 side slope per lift
- 3.5:1 Overall side slope
- Total footprint area of 400 Acres

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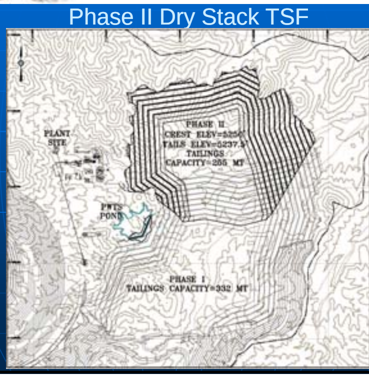
Phase II Dry Stack TSF



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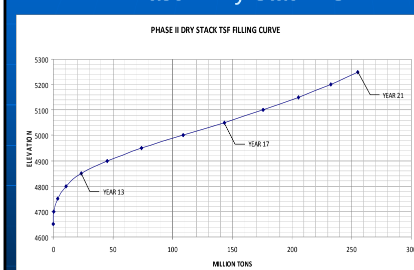
Phase II Dry Stack TSF Filling Curve



	Elev	Tails Volume per Lift (cy)	Total Tails Volume (cy)	Total Tailings Vol (MT)	[illegible]
PHASE II	4650	[illegible]	[illegible]	[illegible]	[illegible]
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	4750	[illegible]	[illegible]	[illegible]	[illegible]
	4800	[illegible]	[illegible]	[illegible]	[illegible]
	4850	[illegible]	[illegible]	[illegible]	[illegible]
	4900	[illegible]	[illegible]	[illegible]	[illegible]
	4950	[illegible]	[illegible]	[illegible]	[illegible]
	5000	[illegible]	[illegible]	[illegible]	[illegible]
	5050	[illegible]	[illegible]	[illegible]	[illegible]
	5100	[illegible]	[illegible]	[illegible]	[illegible]
	5150	[illegible]	[illegible]	[illegible]	[illegible]
	5200	[illegible]	[illegible]	[illegible]	[illegible]
	5250	[illegible]	[illegible]	[illegible]	[illegible]

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Ultimate Dry Stack TSF

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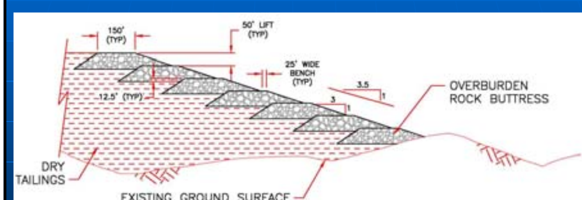
Typical Overburden Rock Buttress Section



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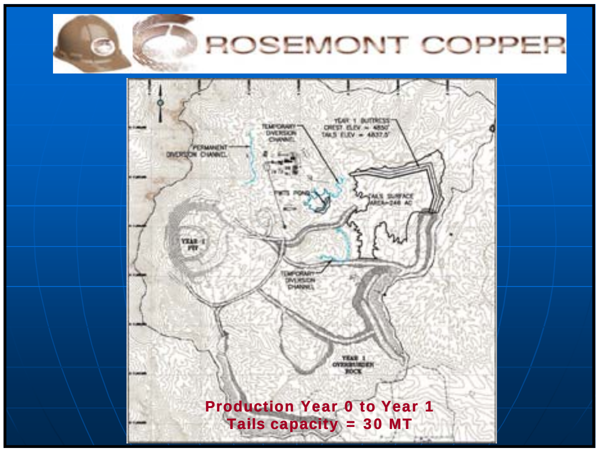
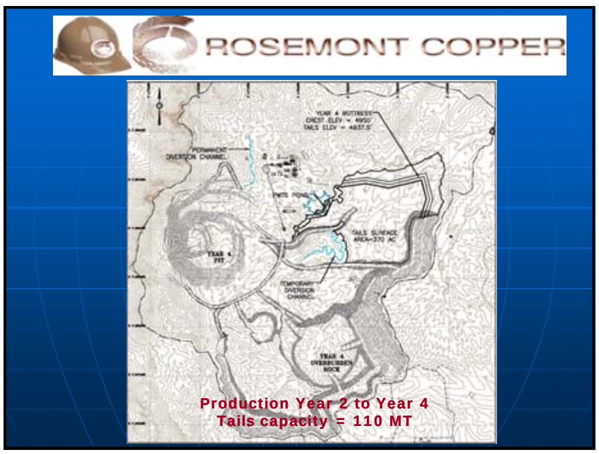
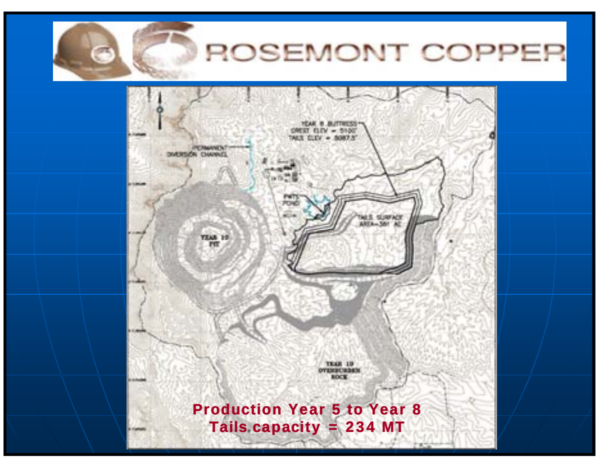
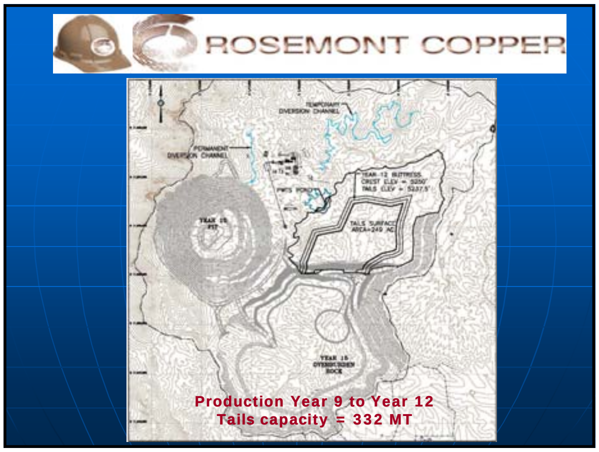
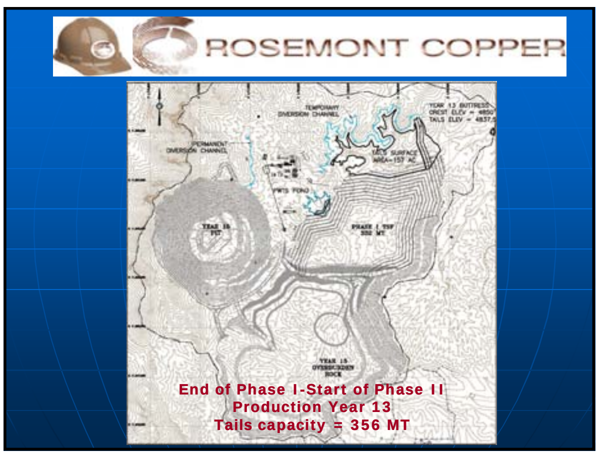
Dry Stack TSF
Stacking Progression

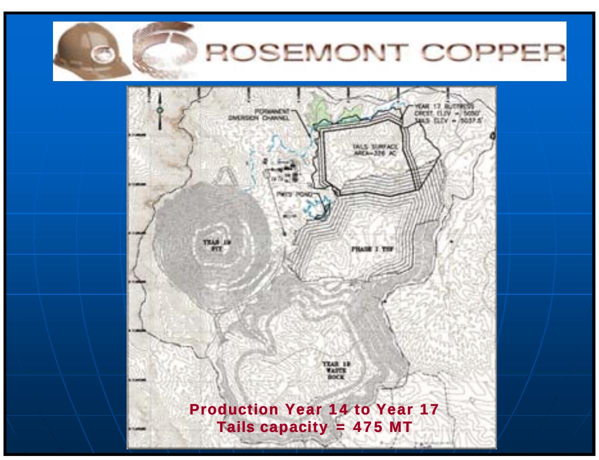

ROSEMONT COPPER
Production Year 0 to Year 1
Tails capacity = 30 MT


ROSEMONT COPPER
Production Year 2 to Year 4
Tails capacity = 110 MT


ROSEMONT COPPER
Production Year 5 to Year 8
Tails capacity = 234 MT


ROSEMONT COPPER
Production Year 9 to Year 12
Tails capacity = 332 MT


ROSEMONT COPPER
End of Phase I-Start of Phase II
Production Year 13
Tails capacity = 356 MT


ROSEMONT COPPER
Production Year 14 to Year 17
Tails capacity = 475 MT

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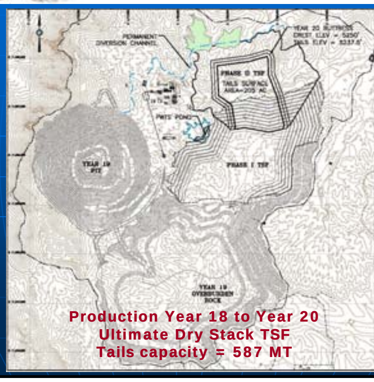

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Permanent Diversion Channel

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Permanent Diversion Channel Design Criteria

- NOAA Atlas 14, Volume 1, Version 4 (2006) data were used for calculations
- Channels are sized for the 200-yr, 24-hr storm event (estimated precipitation is 5.3 inches)
- Channels are assumed to be in rock for the majority of the length. Riprap will be provided in areas of fill
- A 15-foot wide access road will be constructed adjacent to the channel on the downstream side to allow access for maintenance and repair purposes only

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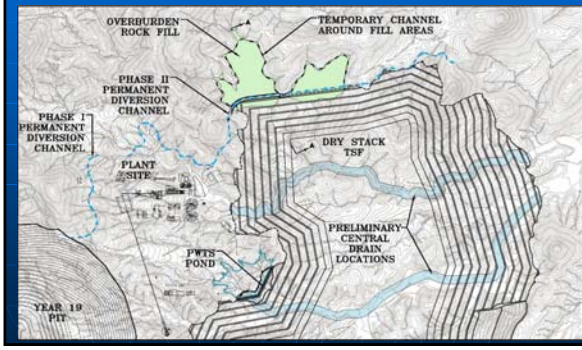
Permanent Diversion Channel



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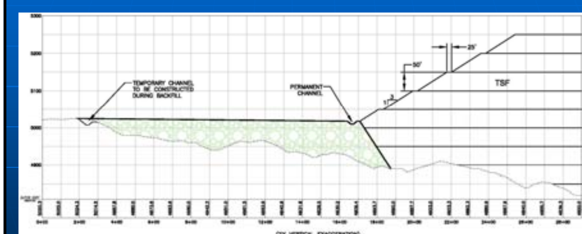
Permanent Channel Section A-A



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Temporary Diversion Channel

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Temporary Diversion Channel Design Criteria

- NOAA Atlas 14, Volume 1, Version 4 (2006) data were used for calculations
- Channels are sized for the 25-yr, 24-hr storm event (estimated precipitation is 3.8 inches)
- Channel locations and alignments are preliminary. Final location and sizing will be determined as final design progresses (location dependant)

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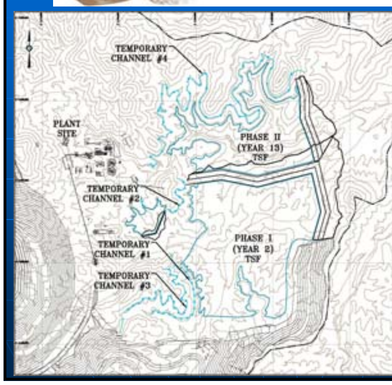

Temporary Diversion Channel Preliminary Construction Schedule

- Temporary Channel #1
  - To be constructed in Year 0 and will be in service for up to Year 2
- Temporary Channel #2
  - Construction is assumed to start in Year 0 and will be in service up to Year 5
- Temporary Channel #3
  - Construction is assumed to start in Year 2 and will be in service up to Year 5
- Temporary Channel #4
  - Construction is assumed to start at the end of Phase I and start of Phase II in Year 12 and will be in service for up to Year 14

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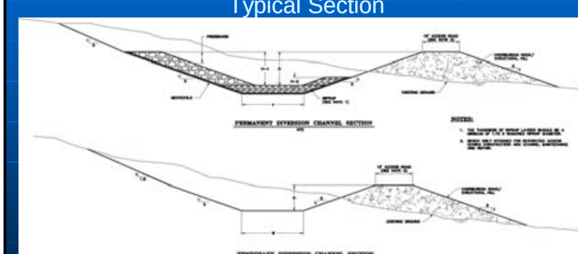
Permanent and Temporary Diversion Channel Typical Section



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Process Water Temporary Storage Pond (PWTS)

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Process Water Temporary Storage Pond (PWTS) Design Criteria

- PWTS to be sized to fully contain the 100-yr, 24-hr storm event (estimated precipitation is 4.7 inches), plus 3-days of process flow during service interruption at the plant facilities
- Requirements and design guidelines by the following agencies:
  - Arizona Department of Water Resources (ADWR) dam safety requirements
  - Arizona Department of Environmental Quality (ADEQ) Best Available Demonstrated Control Technology (BADCT) Standards
- PWTS to be constructed in Year 0
- Embankment to be rockfill/structural fill
- Upstream face to be lined with GCL and 80 mil HDPE
- Stores contact water from plant site

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Process Water Temporary Storage Pond (PWTS) Design Criteria Cont'd.

- Embankment upstream side slopes is 2.5:1
- Embankment downstream side slopes is 2.5:1
- Embankment crest elev. = 4945'
- Provide 3-foot freeboard
- Embankment height at maximum section = ~75'
- Required Storage capacity = 243 Ac.-Ft.
- Designed Storage Capacity = 252 Ac.-Ft.

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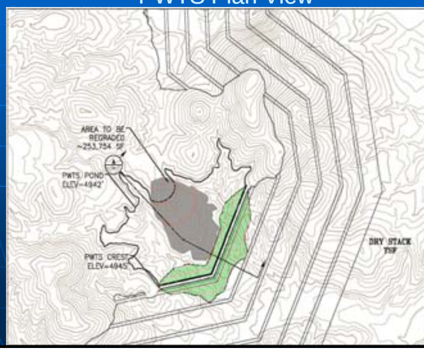
PWTS Plan View



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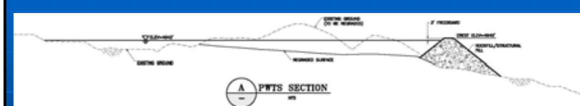

PWTS Embankment Volume	227,384	cy (Fill)
Regrading at Pond Basin (Cut Volume)	237,225	cy (Cut)
PWTS Basin Volume @ El = 4942'	252	Ac.-Ft.

TETRA TECH

Joel Carrasco, EIT
Project Engineer

Mr. Carrasco has over seven years of experience in roadway and drainage design and construction management. He is fluent in Spanish, has a wide range of technical knowledge and has worked on projects throughout the United States, Mexico and Latin America. His experience includes preparing hydrologic and hydraulic analyses and reports, tables, graphs, and plans. His design and construction experience includes tailings impoundments, dam spillways, diversion channels, large multi-plate culverts, concrete bridges and tunnels, geomembrane liner design, open channel bank stabilizations, and stormwater management structures. He has also had experience with design and construction supervision in heap leach projects.

Heap Leach Facility

For the Rosemont Copper Project

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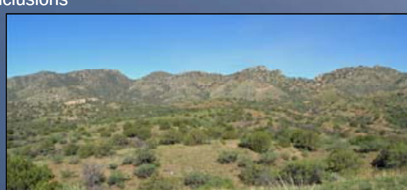
Resourceful.

By Joel Carrasco

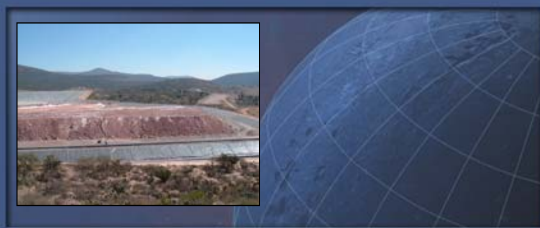
Outline

- General Facility Arrangement
- Design Criteria
- Laboratory Tests
- Items in Progress
- Conclusions



Heap Leach Facility Arrangement

Design Criteria



Pertinent design criteria, along with the approach for the final design of the Rosemont Copper heap leach facility

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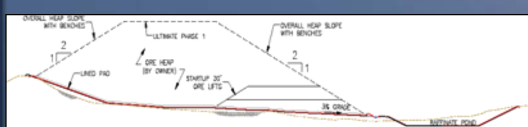
Heap Leach Facility

TETRA TECH

Heap Leach Pad

- Start-up pad at 65 million dry tons with an additional 10 million dry tons.
- Phase 1 Pad capacity of 40 million dry tons.
- Phase 2 Pad capacity of 35 million dry tons.
- 300-foot maximum design height (truck stacked individual ore lifts at natural angle-of-repose between benches).
- 2H:1V overall slopes with benches.



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Heap Leach Facility

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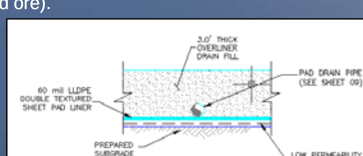
Heap Leach Liner System

- Geosynthethic clay liner (GCL) – equivalent to 12 inches of compacted soil with a saturated hydraulic conductivity of $\leq 10^{-6}$ cm/sec.
- 60 mil smooth/double textured sheet Low Liner Density Polyethylene (LLDPE) geomembrane liner.
- 3-foot minimum thickness of drain cover fill (minus 1.5-inch crushed ore).



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Heap Leach Facility

TETRA TECH

Heap Leach Liner System

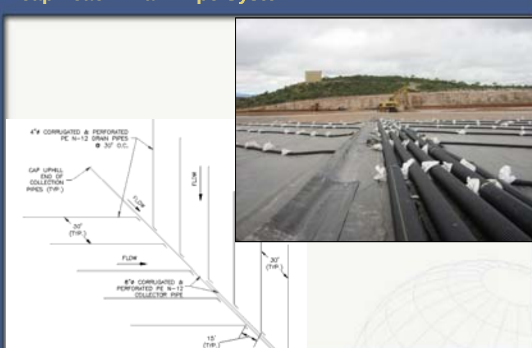
Heap Leach Facility

Heap Leach Drain Pipe System

- Drain pipes spaced as necessary to handle the solution application flows plus estimated 100-yr, 24-hr design storm event
- 4-inch diameter corrugated and perforated dual-wall N-12 PE lateral pipes placed in a herringbone fashion
- 8-inch diameter corrugated and perforated dual-wall N-12 PE collector pipes
- 18-inch diameter corrugated and perforated dual-wall N-12 PE header pipes located at the downhill collection ditch to route flows to pregnant leach solution pond.

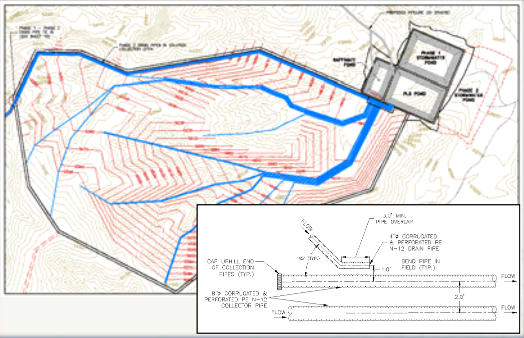
Heap Leach Facility

Heap Leach Drain Pipe System



Heap Leach Facility

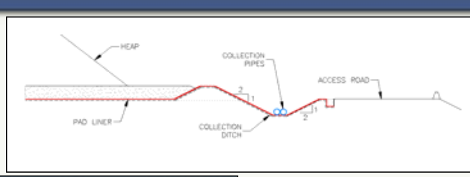
Heap Leach Drain Pipe System



Solution Collection Channel

- The solution collection channel will contain the leach pad drain pipes and convey solutions to the pregnant solution pond.
- Channel will be lined for double containment of the pipelines.
- 80 mil High Density Polyethylene Liner (HDPE)
- Geosynthethic clay liner

Solution Collection Channel



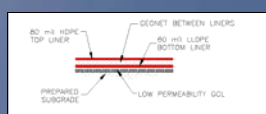
Solution Process Ponds

- The solution collection ponds will collect and store 100 percent of the operational solutions.
- Ponds will contain any temporary drain down and 100-yr 24-hr design storm flows within the lined leach pad area.
- Ponds include a double-lined Pregnant Leach Solution pond, double-lined Raffinate pond and a single-lined Stormwater pond.

Heap Leach Facility

Double-Lined Pond Parameters

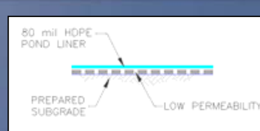
- 25-foot maximum depth
- 3-foot minimum freeboard
- 2.5H:1V maximum lined interior slope
- 80 mil High Density Polyethylene top Liner
- Geonet between liners
- 60 mil Low Liner Density Polyethylene top Liner
- Geosynthethic clay liner
- Leak Collection and Removal System



Heap Leach Facility

Single-Lined Pond Parameters

- 25-foot maximum depth
- 3-foot minimum freeboard
- 2.5H:1V maximum lined interior slope
- 80 mil High Density Polyethylene Liner
- Geosynthethic clay liner



Heap Leach Facility

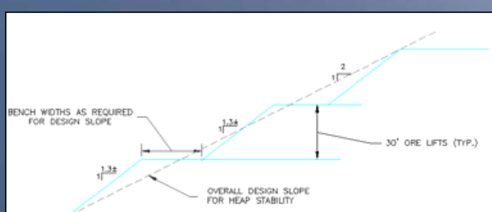
Heap Leach Stability

The heap will be evaluated and designed to provide stability of the heap under static and potential seismic loading conditions.

Heap Leach Facility

Stability

- Minimum static factor of safety of 1.5
- Minimum pseudo-static factor of safety of 1.1



Heap Leach Facility

Laboratory Testing

- Large Scale Interface direct Shear
- Liner Puncture Test
- Alternative materials will collected and tested for liner puncture pending final drain cover selection

- Screened Arkose material through 1 ½ inch sieve
- Smooth 60 mil LLDPE Liner
- GCL
- Loaded to load equivalent to heap height of 450 feet (390 psi)
- Load maintained to a minimum of 48 hours
- Results reveled indentation on liner but no pinholes, vacuum tested for verification

Heap Leach Facility

Liner Puncture Apparatus

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Final Design Items in Progress

- Finalize detail leach pad grading.
- Optimize size and location of process ponds.
- Possible liner puncture test for alternative drain cover material.
- Optimized ore stacking plan

ROSEMONT COPPER | Heap Leach Facility | TETRA TECH

Questions

Joel Carrasco
joel.carrasco@tetratech.com
520.297.7723

ROSEMONT COPPER | Heap Leach Facility | TETRA TECH

Louis C. Thanukos
Manager, Environmental Projects

EXPERTISE: Federal and Selected State Air Regulatory Programs
Source Permitting
Air Toxics
Source Apportionment
Transport and Diffusion Modeling
Visibility
Fugitive Emissions

BACKGROUND: B.A. Physics, University of California, Riverside, 1965
M.S. Physics, Arizona State University, Tempe, 1967
Ph.D. Physics, Arizona State University, Tempe, 1974

Mr. Thanukos directs consulting services in the areas of source permitting, applied research and design, management, and operation of air quality and hazardous substance related environmental projects for industry and government clients. His client industries have included: electrical generating stations, electrical co-generation plants, portland cement plants, lime plants, steel mini-mills, copper smelters, copper heap leaching and SX-EW plants, open pit mines, medical sterilization facilities, scrap recycling plants, electronic industry, soil remediation facilities, furniture and other coating industries, foam insulation and polymer plastics production.

AIR QUALITY ISSUES
AFFECTING
ROSEMONT COPPER COMPANY

Prepared By:

Applied Environmental
Consultants, Inc. (AEC)

AEC RESPONSIBILITIES

- Conduct Background Particulate and Meteorological Monitoring
- Develop the Relevant Information and Conduct the Air Impact Analyses to Demonstrate that the Facility Complies with Environmental Air Quality Requirements
- Prepare Application for an Air Quality Permit, Interface with Appropriate Agencies to Address Air Quality Related Issues

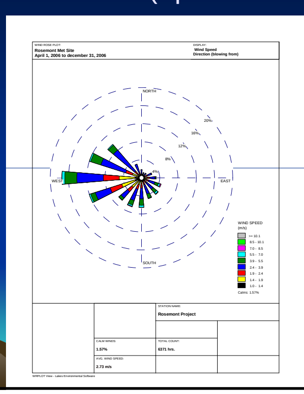
PM_{10} MONITORING SITE

SUMMARY STATISTICS

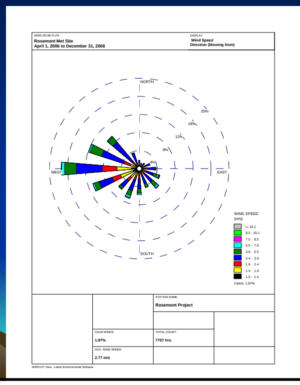
PM$_{10}$ MEASUREMENTS (micrograms/m^3) July 2006 – Sept. 2008			
	2006	2007	2008
Highest	71.3	40.3	32.6
2nd High	27.0	28.7	28.2
3rd High	26.8	27.0	25.2
4th High	24.6	26.6	24.5
Mean	16.1	10.8	12.7

METEOROLOGICAL SYSTEM

2006 Wind Rose (April 1 – Dec. 31)



2007 Wind Rose (Jan. 1 – Dec. 31)



AIR IMPACT ANALYSES

AFFECTED AGENCIES

- PIMA COUNTY DEPARTMENT OF ENVIRONMENTAL QUALITY (PCDEQ)
  - Processes Application for an Air Quality Permit and Issues Permit
- FOREST SERVICE
  - Verifies Compliance with Non-Permit Issues, i.e. Protection of Air Quality Related Values

CONTENT OF PCDEQ APPICATION

- Description of Processes and Operations
- Identification of All Emission Units
- Identification of Maximum Process Rates and Pollution Controls
- Development of Maximum Hourly, Daily, Annual Emission Inventories
- Air Impact Analysis Demonstrating Protection of Applicable Standards
- Demonstration of Compliance with Applicable Emission Standards.

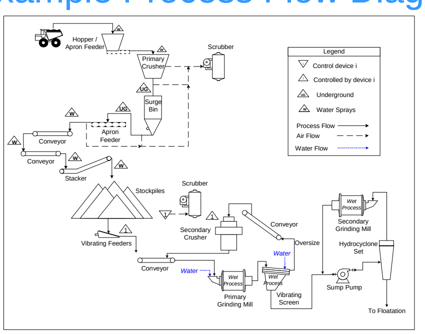
POLLUTANTS OF CONCERN

- Particulate Matter (PM, PM_{10}, $PM_{2.5}$)
- Sulfur Dioxide (SO_2)
- Oxides of Nitrogen (NO_x)
- Carbon Monoxide (CO)
- Volatile Organic Compounds (VOC)
- Hazardous Air Pollutants (HAP, 187 Species)

EMISSION SOURCES

- Mining Activities (Drilling, Blasting, Loading, Hauling, Unloading)
- Ore Processing Operations (Crushing, Screening, Milling, Conveying, Floatation, Product Shipment, etc.)
- Auxiliary Processes (Fuel Combustion Sources)
- Fugitive Emission Sources (Unpaved Roads, Stockpiles, Tailings)
- Mobile Sources (Tailpipe Emissions)

Example Process Flow Diagram



EMISSION INVENTORIES

- Permits Are Issued Based on Max Emmis.
- Use Max. Process Rates (tph, tpy, hp, etc.)
- Select Representative Emission Factors or Rates (All Assumptions Must Be Substantiated)
  - Regulatory Limits
  - Manufacturer's Specifications
  - Mass Balance
  - Computerized EPA Software (TANKS)
  - Emission Factors (EPA's AP-42)
- Select Representative Control Efficiencies & Calculate Emissions

AIR IMPACT ANALYSES

- Demonstrate Protection of Applicable Standards Starting at Process Area Boundary; Visibility at Class I Areas
- Averaging Times of 1-hour, 8-hour, 24-hour, Annual
- EPA Models
  - SCREEN
  - AERMOD
  - VISCREEN
  - PLUVUE
  - CALPUFF
- Meteorological Data Requirements: 1-5 years
- Concurrent Upper Air Meteorological Data - NWS
- Modeling Protocol

CURRENT STATUS

- Continuation of Ambient Monitoring Programs
- Developing Templates for Emission Inventories
- Will Commence on Final Analyses Upon Completion of Final Mine Plan Specifications


QUESTIONS

Lauren Weinstein

Principal, Senior Project Manager

Lauren Weinstein is a principal, founding partner, and senior project manager at EPG. She has 25 years of experience in environmental planning and NEPA compliance, has participated in 30 energy-related projects, and managed numerous transmission line projects. These projects have included the preparation of various environmental analysis documents including EIS, EA, and state certification application documents. Ms. Weinstein also directs EPG's public involvement efforts, which are integrated into a large majority of our projects. These efforts have included community working groups, public meetings, newsletters, and news releases. She has also provided expert testimony before a state siting committee for transmission line facilities. Her experience with projects involving both urban and rural areas include the Hassayampa-Jojoba Transmission Project (500kV), Northeast Phoenix Siting Study (69kV and substations), Navajo Transmission Project (500kV), Santan Generating Station Project (825 MW), Kyrene Generating Station Project (250 MW), Northwest and Northeast Facility Siting Studies (230kV/69kV and substations), North Central Facility Siting Study (230kV, 69kV, and substations), Southwest Valley Project (500kV and substation), El Paso County Facility Siting Study (115kV), Phoenix Expansion Pipeline Project (36- and 42-inch gas pipeline; 260+ miles), and Sedona Pipeline Project, among others. She holds a bachelor's degree in Resource Planning and Management.

Jaime Wood
Project Manager

Jaime Wood has 10 years of experience in environmental sciences and holds a Masters in Environmental Planning. She has performed analytical modeling for numerous environmental studies and permitting efforts, including land use and visual resources for projects involving transmission lines, generating facilities, transportation, and regional planning for the BLM. She is a project manager with experience in meeting requirements under NEPA and regulations of numerous federal, state, and local agencies.

Recent project experience includes serving as assistant project manager for a transmission line siting study within Pinal County, Arizona with a public participation process that includes the formation of a stakeholder group who meets at key milestones throughout the planning process. She has also served as a project coordinator for regional feasibility studies in identifying potential EHV transmission line corridors within the states of Idaho, Wyoming, Colorado, Utah, Montana, and Arizona. She was a project coordinator for preparation and submittal to the BLM Wyoming State Office of right-of-way applications and preliminary plan of development documents for up to two 500kV transmission lines connecting major substations within Wyoming, Utah, Nevada, and Arizona. Jaime has served as project manager for siting a distribution line within the Prescott National Forest, located in northern Arizona. She was a project coordinator for two EHV transmission line siting studies within Phoenix, Arizona. She also has served as project coordinator for two power plants: La Paz generating facility, located in La Paz County, Arizona, and Bowie Power Station, located in Cochise County, Arizona. Jaime has participated in three Arizona CEC permitting efforts for EHV transmission lines and generating facilities. She has coordinated with federal, state, and local agencies, as well as public participation processes for local and regional projects. Jaime has assisted the BLM in revising several Resource Management Plans (RMPs) within the states of Arizona and New Mexico.

ROSEMONT 138-KV TRANSMISSION LINE PROJECT

Team Building and Technology Transfer

November 12, 2008

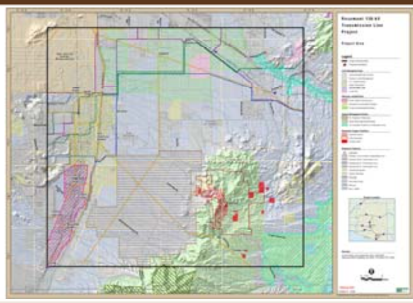
PURPOSE AND NEED

- Rosemont Copper Company has requested TEP to provide electric power to the Rosemont operations
- The proposed 138-kV transmission line and substation would be needed to provided adequate and reliable power for operation of the proposed Rosemont facilities
- No existing transmission lines and substations could serve this purpose and need

PROJECT DESCRIPTION

- Up to 28 miles of 138-kV transmission line connecting from either the Vail or South substations to the proposed Rosemont Substation (located on private land). The proposed 138-kV transmission line will require a new 100-foot-wide right-of-way
- Project area (approximately 560 square miles) consists predominantly of land owned by Arizona State Land Department, private, U.S. National Forest, and interspersed with some BLM land
- The planning process will demonstrate a thorough comparison of alternatives, including how information will be gathered during the public planning process and used to identify the preferred and alternative route(s)

PROJECT AREA



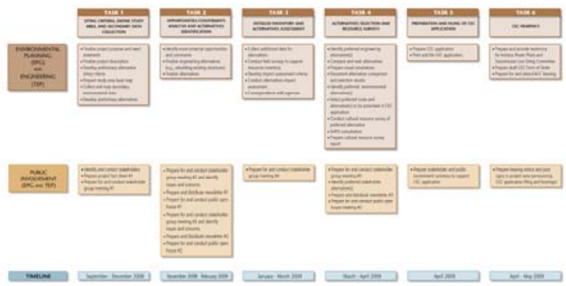
PROJECT DESCRIPTION (CONTINUED)

- The planning process will be summarized in a Certificate of Environmental Compatibility (CEC) application, which is required by the Arizona Corporation Commission (ACC) for construction and operation of the 138-kV transmission line

SITING AND PLANNING PROCESS

- Comprehensive planning process consisting of six key tasks
- Studies will include environmental and engineering analysis, along with agency/public input
- Several alternatives will be identified and evaluated to meet the project purpose and need
- TEP/Rosemont Copper Company will identify a preferred route for permitting and construction, as well as alternative routes
- TEP will prepare and file a CEC application to be reviewed by the Arizona Power Plant and Transmission Line Siting Committee
- The ACC will make a final decision to approve (with any conditions) or deny the CEC application

ENVIRONMENTAL PLANNING PROCESS



ENVIRONMENTAL STUDIES

- Environmental resources
  - Land use (existing/future land use and jurisdictional planning guidelines)
  - Visual (scenic quality, sensitive viewers, and scenic management guidelines)
  - Cultural (National Register or eligible sites and archaeological sites)
  - Biology (wildlife, vegetation, special status species, critical habitat)
- Environmental studies will be coordinated with SWCA and WestLand Resources to ensure consistency with the EIS

ENVIRONMENTAL STUDIES

- Environmental resources:
  - **Land use**
    (existing/future land use and jurisdictional planning guidelines)
  - **Visual**
    (scenic quality, sensitive viewers, and scenic management guidelines)
  - **Cultural**
    (National Register or eligible sites and archaeological sites)
  - **Biology**
    (wildlife, vegetation, special status species, critical habitat)
- Environmental studies will be coordinated with SWCA and WestLand Resources to ensure consistency with the EIS

PUBLIC PARTICIPATION

- Community stakeholder group
- Project fact sheet/newsletters
- Project mailing list
- Toll-free project information line
- TEP website (www.tep.com)
- Media briefings
- Project newsletters mailed to community, including residents, landowners, and other interested parties

ROSEMONT 138-KV TRANSMISSION LINE PROJECT

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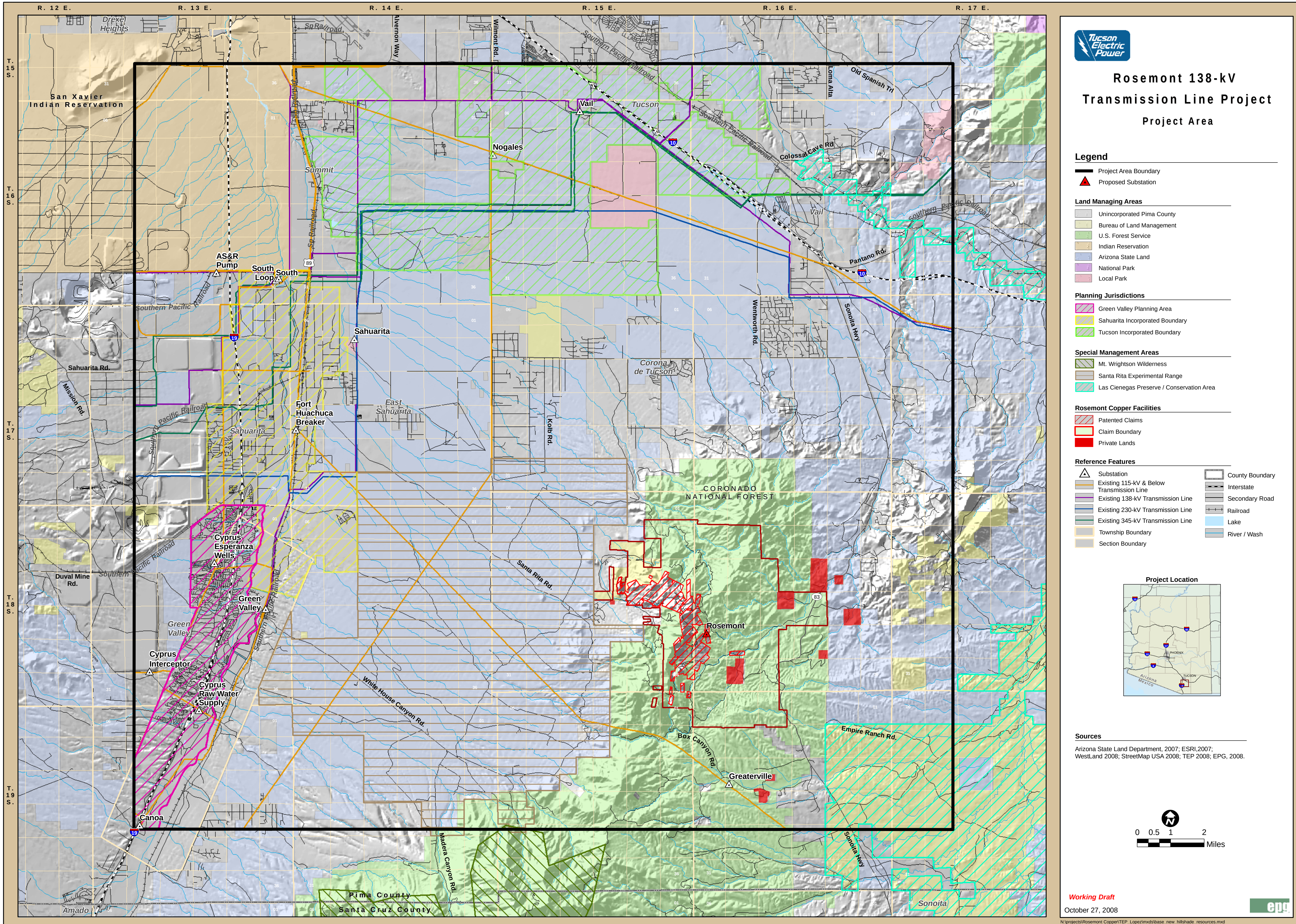

Tucson Electric Power
Rosemont 138-kV
Transmission Line Project
Project Area
Legend
Project Area Boundary
Proposed Substation
Land Managing Areas
Unincorporated Pima County
Bureau of Land Management
U.S. Forest Service
Indian Reservation
Arizona State Land
National Park
Local Park
Planning Jurisdictions
Green Valley Planning Area
Sahuarita Incorporated Boundary
Tucson Incorporated Boundary
Special Management Areas
Mt. Wrightson Wilderness
Santa Rita Experimental Range
Las Cienegas Preserve / Conservation Area
Rosemont Copper Facilities
Patented Claims
Claim Boundary
Private Lands
Reference Features
Substation
Existing 115-kV & Below Transmission Line
Existing 138-kV Transmission Line
Existing 230-kV Transmission Line
Existing 345-kV Transmission Line
Township Boundary
Section Boundary
County Boundary
Interstate
Secondary Road
Railroad
Lake
River / Wash
Project Location
PHOENIX
TUCSON
Arizona
Mexico
Sources
Arizona State Land Department, 2007; ESRI,2007; WestLand 2008; StreetMap USA 2008; TEP 2008; EPG, 2008.
0 0.5 1 2
Miles
Working Draft
October 27, 2008
epg
N:\projects\Rosemont Copper\TEP_Lopez\mxds\base_new_hillshade_resources.mxd
R. 12 E.
R. 13 E.
R. 14 E.
R. 15 E.
R. 16 E.
R. 17 E.
T. 15 S.
T. 16 S.
T. 17 S.
T. 18 S.
T. 19 S.
San Xavier Indian Reservation
Drexel Heights
Vail
Tucson
Nogales
Summit
AS&R Pump
South Loop
South
Sahuarita
Sahuarita Rd.
Mission Rd.
Fort Huachuca Breaker
East Sahuarita
Corona de Tucson
Cyprus Esperanza Wells
Green Valley
Cyprus Interceptor
Cyprus Raw Water Supply
Duval Mine Rd.
Canoa
Amado
CORONADO NATIONAL FOREST
Rosemont
Greaterville
Santa Rita Rd.
White House Canyon Rd.
Box Canyon Rd.
Empire Ranch Rd.
Madera Canyon Rd.
Kolb Rd.
Wentworth Rd.
Sonoita Hwy
Sonoita
Pantano Rd.
Colossal Cave Rd
Old Spanish Trl
Loma Alta
Wilmot Rd.
Alvernon Way
Southern Pacific Railroad
Pima County
Santa Cruz County

	TASK 1	TASK 2	TASK 3	TASK 4	TASK 5	TASK 6
	SITING CRITERIA, DEFINE STUDY AREA, AND SECONDARY DATA COLLECTION	OPPORTUNITIES/CONSTRAINTS ANALYSIS AND ALTERNATIVES IDENTIFICATION	DETAILED INVENTORY AND ALTERNATIVES ASSESSMENT	ALTERNATIVES SELECTION AND RESOURCE SURVEYS	PREPARATION AND FILING OF CEC APPLICATION	CEC HEARINGS
ENVIRONMENTAL PLANNING (EPG) AND ENGINEERING (TEP)	• Finalize project purpose and need statement • Finalize project description • Develop preliminary alternative siting criteria • Prepare study area base map • Collect and map secondary environmental data • Develop preliminary alternatives	• Identify environmental opportunities and constraints • Finalize engineering alternatives (e.g., rebuilding existing structures) • Finalize alternatives	• Collect additional data for alternatives • Conduct field surveys to support resources inventory • Develop impact assessment criteria • Conduct alternatives impact assessment • Correspondence with agencies	• Identify preferred engineering alternative(s) • Compare and rank alternatives • Prepare visual simulations • Document alternative comparison and selection results • Identify preferred environmental alternative(s) • Select preferred route and alternative(s) to be presented in CEC application • Conduct cultural resource survey of preferred alternative • SHPO consultation • Prepare cultural resource survey report	• Prepare CEC application • Print and file CEC application	• Prepare and provide testimony for Arizona Power Plant and Transmission Line Siting Committee • Prepare draft CEC Form of Order • Prepare for and attend ACC hearing
PUBLIC INVOLVEMENT (EPG AND TEP)	• Identify and contact stakeholders • Prepare project fact sheet #1 • Prepare for and conduct stakeholder group meeting #1	• Prepare for and conduct stakeholder group meeting #2 and identify issues and concerns • Prepare and distribute newsletter #1 • Prepare for and conduct public open house #1 • Prepare for and conduct stakeholder group meeting #3 and identify issues and concerns • Prepare and distribute newsletter #2 • Prepare for and conduct public open house #2	• Prepare for and conduct stakeholder group meeting #4	• Prepare for and conduct stakeholder group meeting #5 • Identify preferred stakeholder alternative(s) • Prepare and distribute newsletter #3 • Prepare for and conduct public open house meeting #3	• Prepare stakeholder and public involvement summary to support CEC application	• Prepare hearing notice and post signs in project area (announcing CEC application filing and hearings)
TIMELINE	September - December 2008	November 2008 - February 2009	January - March 2009	March - April 2009	April 2009	April - May 2009

Tucson Electric Power

epg

November 2008

Planning Process and Responsibilities

Certificate of Environmental Compatibility (CEC) Application

Rosemont 138-kV Transmission Line Project

TETRA TECH

Robert Sculley

Air Quality/Noise Scientist

Mr. Sculley combines an academic background in terrestrial ecology, aquatic ecology, and environmental planning with 36 years of experience as an environmental consultant. Most of his experience involves quantitative evaluations, with an emphasis on air quality and noise analyses for environmental impact studies, environmental planning studies, and environmental compliance purposes. His noise assessment experience includes noise monitoring studies, noise analyses for environmental impact assessments, and preparation of general plan noise elements. He has developed spreadsheet models for evaluating noise in construction activities, highway traffic, rail operations, aircraft flyovers, blasting, and small arms firing ranges. His environmental impact assessment experience in noise analysis includes: construction, traffic, rail, aircraft flyovers, wind farms, exploratory drilling, industrial facilities, blasting, military training ranges, and small arms firing. He also has experience in noise modeling programs including the following: (Sound 2000, TNM Lookup, and TNM for highway traffic noise; RCNM for construction equipment noise; FTAnoise, HSRnoise, and FTA Horn Noise for rail operations noise; BNOISE for blast noise from military weapons and explosives; SARNAM for noise from small arm firing; OMEGA10 and PCBOOM for noise from aircraft operations).

TETRA TECH

Noise Study

For the Rosemont Copper Project

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Resourceful.

By Robert Sculley &
Michael Dieckhaus

Purpose of the Noise Study

- Identify existing background noise levels in the project area
- Provide information on noise levels at active copper mines
- Provide preliminary noise modeling analyses of traffic noise and blasting noise

Notes from the Noise Study

- Noise modeling analyses have not been completed yet
- This presentation will focus on the results from the ambient noise monitoring program

Background Noise Monitoring at Project Area

- Multi-day noise monitoring at locations closest to existing residences
- Multi-day monitoring at other locations representative of project area conditions
- 5 locations in southern part of project area (closest to residences) monitored for a 3 day period over Memorial Day weekend

Noise Study

Background Noise Monitoring Approach

- 1 location in the northern part of the project area (closest to residences) monitored for a 2 day period after Memorial Day weekend
- 2 locations near the proposed mine pit area monitored for 2 days after Memorial Day weekend

Noise Study

Active Copper Mine Noise Monitoring Approach

- Emphasis on monitoring blasting events at an active copper mine
- First monitoring at 2 locations approximately one mile from a blast location
- Several hours of monitoring to include background noise levels from haul trucks, shovel and other general mine activity

Noise Study

Active Copper Mine Noise Monitoring Approach

- Supplemental noise monitoring at the same active mine included:
  - Two additional blast events
  - 3 locations at various distances from the blast
  - Two noise meters at each location, one running for 8 hours, the other running continuously for 48 hours

ROSEMONT COPPER — Noise Study — TETRA TECH

Active Copper Mine Supplemental Noise Monitoring

- Locations of monitoring included:
  - At the edge of the pit with line-of-site to the blast locations (0.25 and 0.5 miles from the two blast sites)
  - 100 feet from the edge of the pit (0.25 and 0.5 miles from the two blast sites)
  - Along a haul road one mile from the blast sites, and close to a truck wash facility

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Noise Monitoring Instrumentation

- Two types of noise meters used for the study
  - Primary: Larson Davis model 820 sound level meters
    - Type 1 (precision) integrating sound level meter
    - Dynamic measurement range from 18 dBA to 110 dBA
  - Secondary: Center Technology model 322 sound level meters
    - Type 2 (general purpose) sound pressure level meter; not an integrating sound level meter
    - Auto-ranging with dynamic range from slightly under 30 dBA to 100 dBA

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Larson Davis Model 820 Sound Level Meter

Noise Study

Center Technology Model 322 Sound Level Meter

Noise Study

Basic Field Procedures

- Instruments set to A weighting, fast response
- Larson Davis meters set to log one-minute basic time histories and 15-minute interval histories
- Center 322 meters set to log data at one-second intervals or at 3-second intervals
- Instruments mounted on camera tripods at a height of about 5 feet
- Instruments calibrated with a Larson Davis Class 1 acoustic calibrator

Noise Study

A-Weighted Decibel Examples

CHARACTERIZATION	dBA	EXAMPLE NOISE CONDITION OR EVENT
Threshold of pain	130	Surface detonation, 30 pounds of TNT at 1,000 feet
	125	F/A-18 aircraft takeoff with afterburner at 470 feet
Possible building damage	120	Mach 1.1 sonic boom under aircraft at 12,000 feet
Threshold for immediate NIPTS	115	Commercial fireworks (5 lb charge) at 1,500 feet
	110	Peak crowd noise, pro football game, open stadium
	105	Emergency vehicle siren at 50 feet
	100	Jackhammer at 10 feet; 1-mile range fog horn at 30 feet
Extremely noisy	95	Locomotive horn at 100 feet; 2-mile range fog horn at 100 feet
8-hour OSHA limit	90	Heavy truck, 35 mph at 20 ft; Leaf blower at 5 ft
Very noisy	85	Gas engine lawn mower at 5 feet; City bus at 30 feet
	80	2-Axle commercial truck, 35 mph at 20 feet
Noisy	75	Street sweeper at 30 feet; Idling locomotive at 50 ft
	70	Auto, 35 mph at 20 ft; 300 ft from busy 6-lane freeway

Noise Study

A-Weighted Decibel Examples

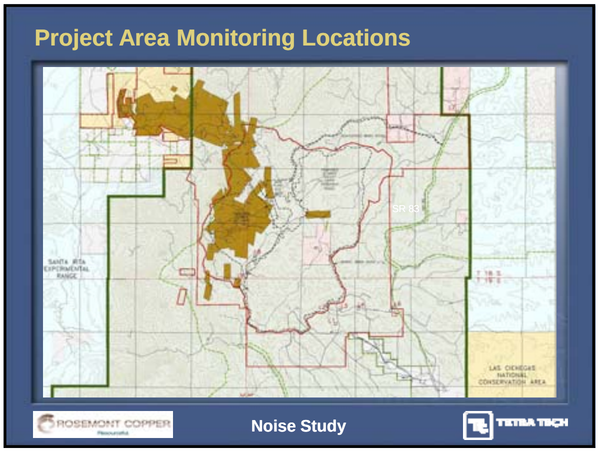
CHARACTERIZATION	dBA	EXAMPLE NOISE CONDITION OR EVENT
Moderately noisy	65	Typical daytime busy downtown background conditions
	60	Typical daytime urban mixed use area conditions
	55	Typical urban residential area away from major streets
	50	Typical daytime suburban background conditions
Quiet	45	Typical rural area daytime background conditions
	40	Typical suburban area at night
	35	Quiet suburban area at night
Very quiet	30	Quiet rural area, winter night, no wind
	25	---
	20	Empty recording studio; Remote area, no audible sounds
	15	---
Barely audible	10	Audiometric testing booth
	5	---
Threshold of Hearing, no hearing loss	0	---

Noise Study

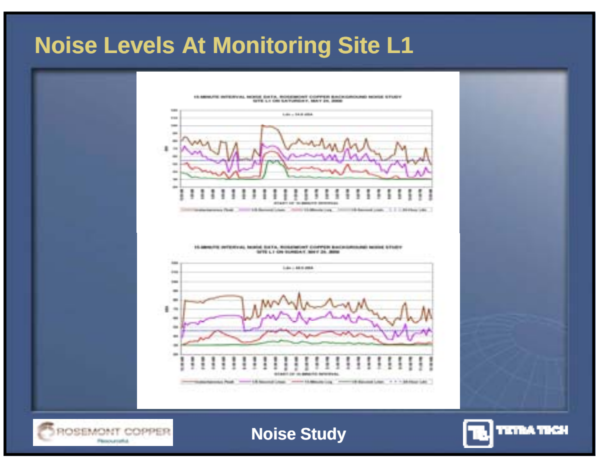
Important Noise Measurement Terms

- Leq = equivalent constant noise level (“energy-averaged” noise level)
- Ldn = day-night average noise level (a 24-hour Leq with a 10 dBA penalty factor added to nighttime [10 pm to 7 am] noise levels)
- Lmax = maximum Leq over 1/8 second intervals at fast response setting; Lmax is how people hear rapidly fluctuating noise

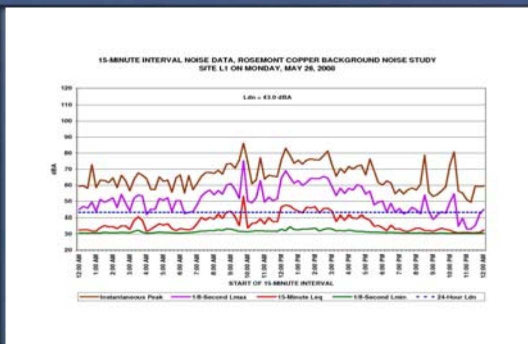
Noise Study


Project Area Monitoring Locations
SANTA RITA EXPERIMENTAL RANGE
LAS CIENEGAS NATIONAL CONSERVATION AREA
ROSEMONT COPPER
Noise Study
TETRA TECH


Meter at Monitoring Site L1
ROSEMONT COPPER
Noise Study
TETRA TECH


Noise Levels At Monitoring Site L1
ROSEMONT COPPER
Noise Study
TETRA TECH

Noise Levels At Monitoring Site L1



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Noise Study

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Meter at Monitoring Site L2

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Noise Study

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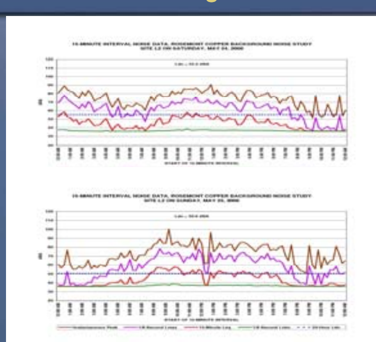
Noise Levels At Monitoring Site L2



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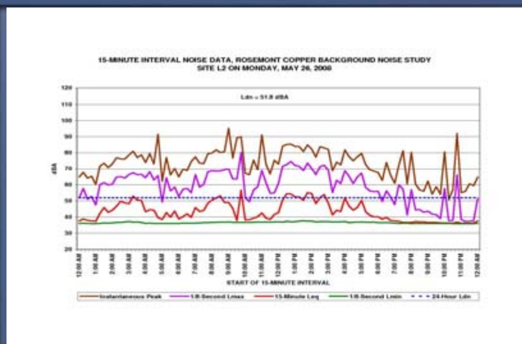
Noise Study

TETRA TECH

Noise Levels At Monitoring Site L2

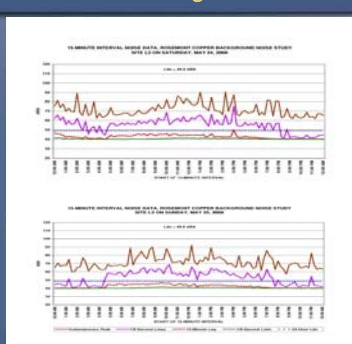


Noise Study

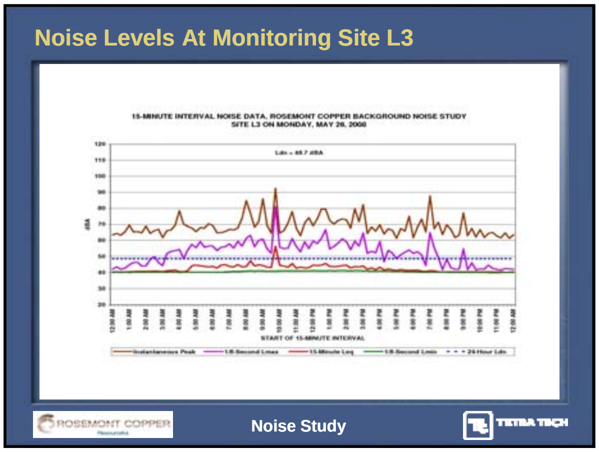
Meter at Monitoring Site L3

Noise Study

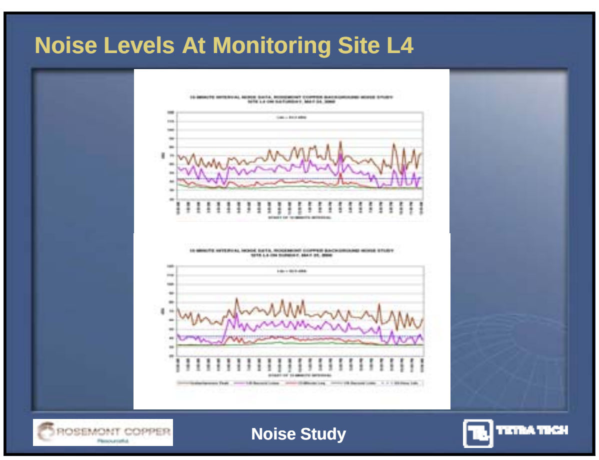
Noise Levels At Monitoring Site L3



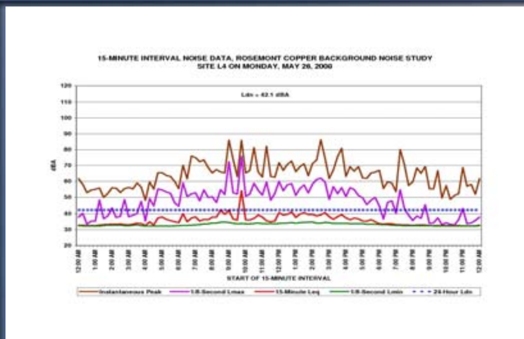
Noise Study


Noise Levels At Monitoring Site L3
15-MINUTE INTERVAL NOISE DATA, ROSEMONT COPPER BACKGROUND NOISE STUDY
START OF 15-MINUTE INTERVAL
ROSEMONT COPPER
Noise Study
TETRA TECH


Meter at Monitoring Site L4
ROSEMONT COPPER
Noise Study
TETRA TECH


Noise Levels At Monitoring Site L4
ROSEMONT COPPER
Noise Study
TETRA TECH

Noise Levels At Monitoring Site L4

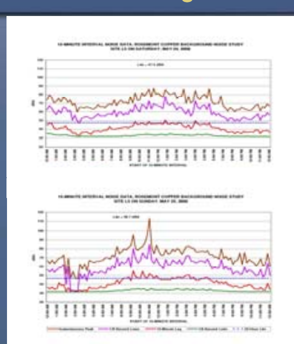


Noise Study

Meter at Monitoring Site L5

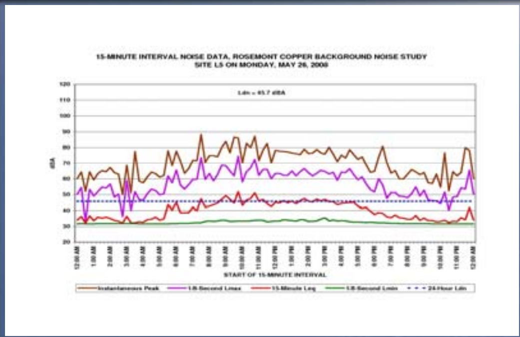
Noise Study

Noise Levels At Monitoring Site L5



Noise Study

Noise Levels At Monitoring Site L5



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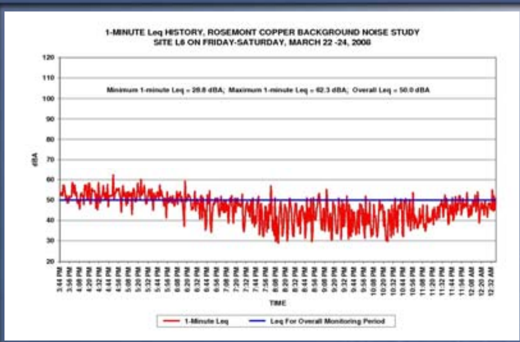
Meter at Monitoring Site L6

ROSEMONT COPPER Noise Study TETRA TECH

Noise Levels At Monitoring Site L6

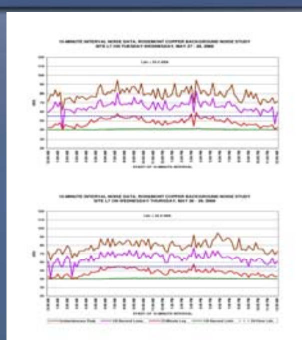


ROSEMONT COPPER Noise Study TETRA TECH

Meters at Monitoring Site L7

ROSEMONT COPPER | Noise Study | TETRA TECH

Noise Levels At Monitoring Site L7 – LD820



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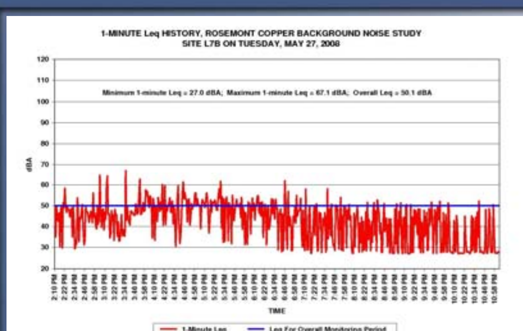
Noise Levels At Monitoring Site L7 – C322



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Meter at Monitoring Site L8

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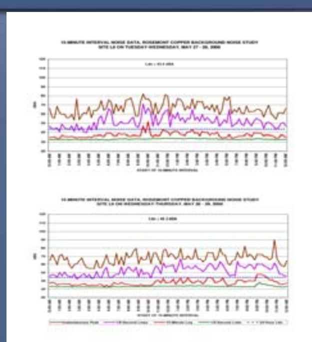
Noise Levels At Monitoring Site L8



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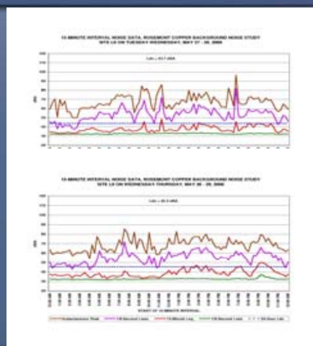
Meter at Monitoring Site L9

ROSEMONT COPPER Noise Study TETRA TECH 39

Noise Levels At Monitoring Site L9



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Conclusions: Project Area Noise Levels

- Low existing average noise levels in the project vicinity
- Noise levels mostly less than 45 dBA
- Noise levels higher on ridge lines than in intervening valleys
- Noise levels higher close to State Route (SR) 83, but relatively low more than a few hundred feet from SR 83
- Background noise levels somewhat higher during periods with strong winds
- Brief instances of moderately high noise levels (i.e. high wind, traffic, horns, activity near the meters)

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Active Copper Mine Area Noise Monitoring

- Unspecified active copper mine in Pima County, Arizona
- Selected due to:
  - Accessible for study
  - Similar topography as proposed mine
  - Active mining activities with blasting, haul trucks, drilling, vehicle washing

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Active Copper Mine Area Noise Monitoring

- Noise levels monitored at same mine in May 2008 and October 2008
- Focused on blasting events but also general background noise levels and haul/drilling noise levels
- Three blast events monitored with following charge sizes:
  - Two events 30 to 40 holes,
  - One event had 65 holes

Active Mine Area Noise Monitoring

- Blast monitoring locations ¼ mile to one mile
  - One monitoring site: direct line of sight to blast areas with no terrain shielding
  - One monitoring site: terrain shielding from pit walls only
  - Other monitoring sites: terrain shielding from both pit walls and other terrain features

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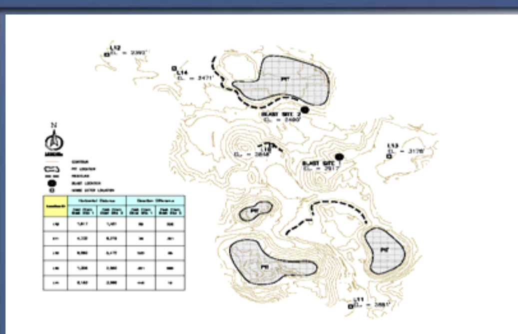
Schematic Diagram of Mine Area Monitoring



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Noise Levels At Monitoring Site L10

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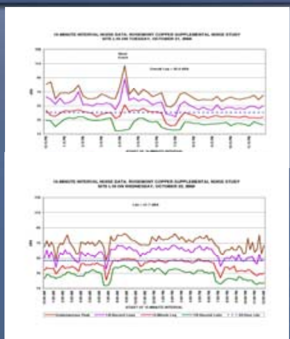
Noise Levels At Monitoring Site L10



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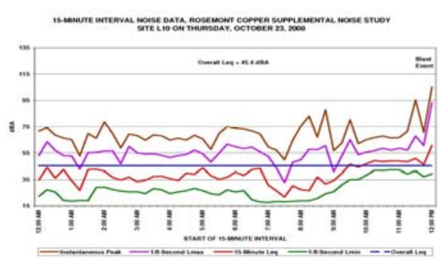
Noise Levels At Monitoring Site L10



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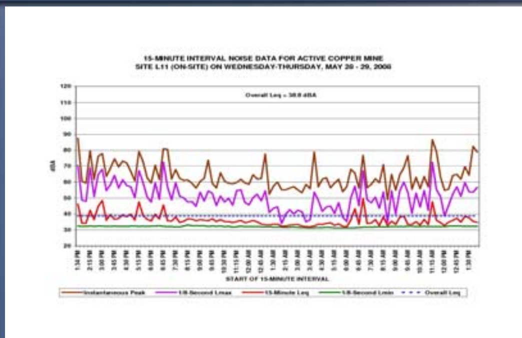
Noise Levels At Monitoring Site L11



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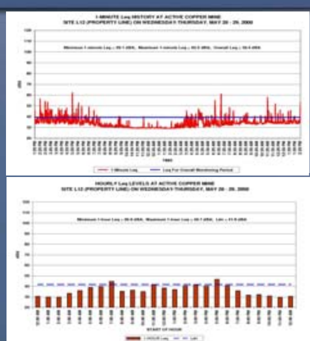
Noise Levels At Monitoring Site L12



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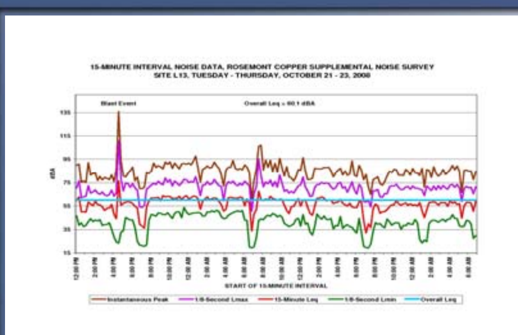
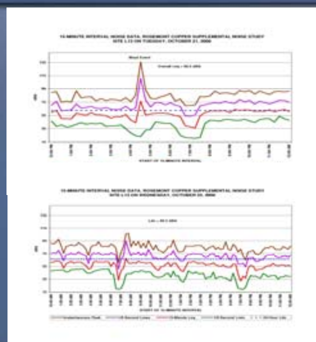
Noise Levels At Monitoring Site L13



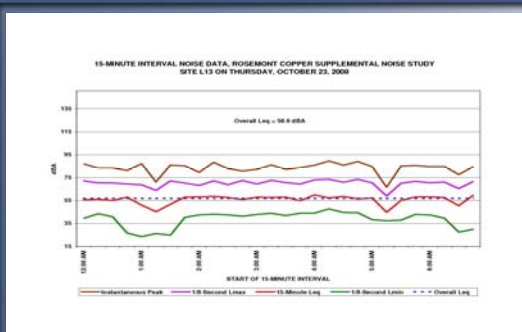
ROSEMONT COPPER | Noise Study | TETRA TECH

Noise Levels At Monitoring Site L13



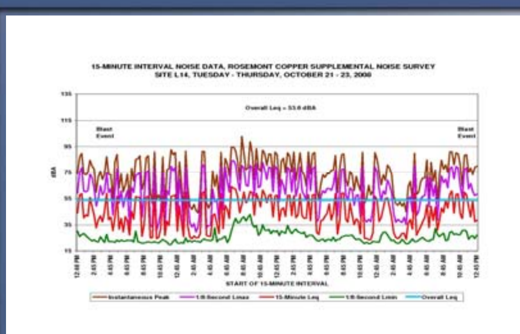
Noise Study

Noise Levels At Monitoring Site L13



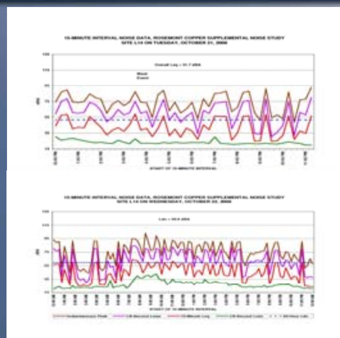
Noise Study

Noise Levels At Monitoring Site L14



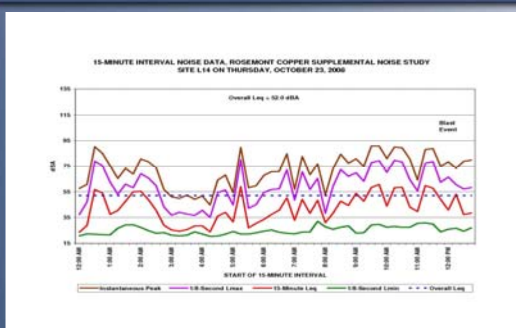
Noise Study

Noise Levels At Monitoring Site L14



ROSEMONT COPPER | Noise Study | TETRA TECH

Noise Levels At Monitoring Site L14



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Conclusions: Active Mining Area Noise Levels

- Low overall noise levels
- Average noise levels comparable to existing background noise levels in the Rosemont project area
- Relatively high noise levels limited to the immediate vicinity of heavy equipment operations (active mining pit, haul roads, and active leach dump areas)

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Conclusions: Active Mining Area Noise Levels

- Blast events generated high noise levels for approximately one second
- At distances > 3/4 mile from the pit area, blast noise levels comparable to ambient background noise levels
- Maximum pass-by noise levels from haul trucks comparable to those for heavy trucks on highways
- Minimum noise levels at the active mine lower than those monitored in the Rosemont project area

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Questions

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Kekoa Anderson, P.E.
Director of Transportation

Kekoa Anderson, P.E. (CA) has 22 years of civil engineering experience, managing both conceptual and final design projects with an emphasis on highways, bridges, drainage facilities, rail, and arterial streets. He is knowledgeable with respect to Federal Highway Administration, Departments of Transportation throughout the Western States (specifically Caltrans), American Association of State Highway and Transportation Officials (AASHTO), and American Railway Engineer Association (AREA) procedures and standards. He has served on a number of Value Analysis Studies and participated in a number of Major Investment Studies for both highway and rail. He has worked with the Los Angeles County Metropolitan Transportation Authority (LACMTA), Metrolink System, California Public Utilities Commission (CPUC), Orange County Transportation Authority (OCTA), and numerous local agencies throughout California. He has received the Certificate of Award from the Federal Highway Association for Most Outstanding Value Engineering Study of 2001.

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Traffic Study

For the Rosemont Copper Project

ROSEMONT COPPER
Resourceful.

By Kekoa Anderson, P.E.,
David Bost &
Seri Park, Ph.D.

Presentation Agenda

- Traffic Study Elements
  - Traffic Analysis
  - Study Site
  - Traffic Data
- Level of Service Analysis
  - Simulations
- Roadway Assessment
  - Safety Analysis
  - Geometric Analysis
- Findings
- Q&A

Traffic Study Elements – Traffic Analysis

Current Traffic Data Collection

↓

Traffic Forecasts
•Construction Year
•Interim Mine Operation (Year 5)
• Ultimate Mine Life (Year 20)

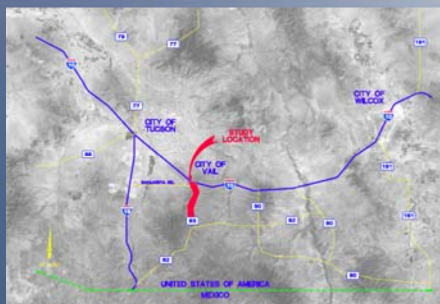
↓

Traffic Operation/LOS Analysis
•Intersections
•Corridor

↓

Need improvements?

Traffic Study Elements – Study Site



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Traffic Study Elements – Key Intersections

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Traffic Study Elements – Traffic Data

- Traffic Data
  - Current Traffic Counts
  - Traffic Forecasts
    - Construction Year
    - Interim Mine Operation (Year 5)
    - Ultimate Mine (Year 20)

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Current Traffic Counts

- Data collection
  - Seasonal – peak season, non-peak season
  - Day – weekday, weekend
  - Time – AM and PM peak period
    - 6:30-8:00 AM, 5:00-7:00 PM
  - Seven (7) major intersections
- Method
  - Manual traffic count
  - Video recording

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Current Traffic Counts

- 5 Different vehicle types
  - Motorcycle
  - Light duty vehicles (autos, pickup trucks, SUVs, etc.)
  - Buses
  - Median trucks (2-axle, 6-tire)
  - Heavy trucks (3 or more axles)
- Truck traffic
  - Convert into the passenger car equivalent (PCE) factors for accurate Level of Service (LOS) analysis

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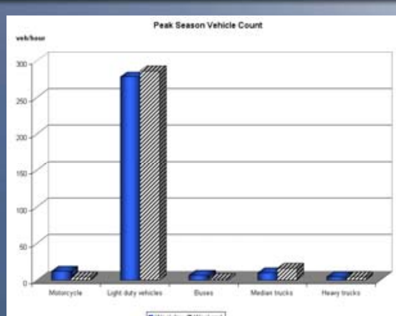
Current Traffic Counts



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Truck Volumes

Average
Annual
Daily
Truck
Volumes

Traffic Study

Traffic Forecasts

- Future land use
- Update origin destination matrix
- Assignment of trips

Traffic Study

Traffic Forecasts

- Traffic Forecasts
  - Project trip
    - Mine operation trip
  - Background trip
    - Regional growth
    - Pima Association of Governments (PAG) travel demand model
    - ADOT major projects

Traffic Study

Level of Service Analysis

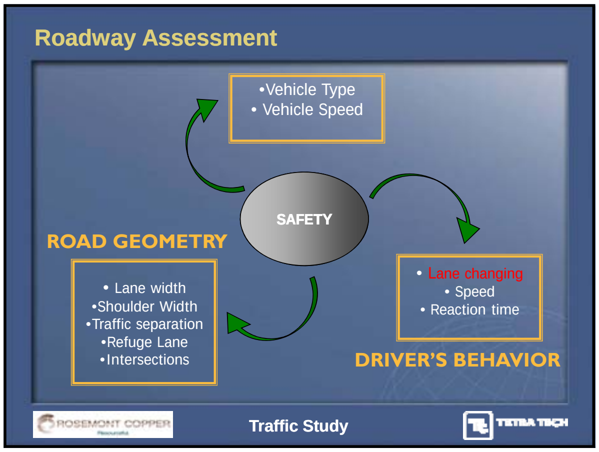
- Four analysis years
  - Current year (2008)
  - Construction year (2010)
  - Interim mine year (5 years)
  - Ultimate mine year (20 years)

Level of Service Analysis

	Current Year	Construction Year	Interim Mine Year (Year 5)	Ultimate Mine Year (Year 20)
Intersection LOS	LOS A-B	LOS A-B	LOS A-B	LOS A-B
Segment LOS	LOS B	LOS C	LOS C,D	LOS C, D
Findings	Acceptable LOS	Acceptable LOS	▪Left turn issue ▪Non passing zone issue ▪Need for roadway geometric modification	▪Left turn issue ▪Non passing zone issue ▪Need for roadway geometric modification

SimTraffic

- SimTraffic Simulation


Roadway Assessment
•Vehicle Type
• Vehicle Speed
SAFETY
ROAD GEOMETRY
• Lane width
•Shoulder Width
•Traffic separation
•Refuge Lane
•Intersections
• Lane changing
• Speed
• Reaction time
DRIVER'S BEHAVIOR
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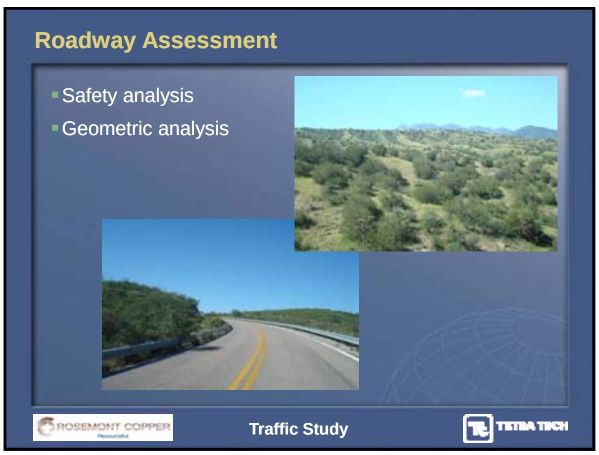
Roadway Assessment
Safety analysis
Geometric analysis
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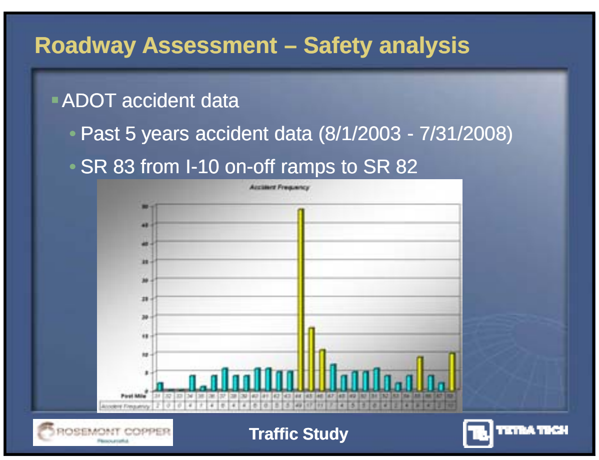
Roadway Assessment – Safety analysis
ADOT accident data
Past 5 years accident data (8/1/2003 - 7/31/2008)
SR 83 from I-10 on-off ramps to SR 82
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Roadway Assessment – Safety analysis

- Federal Requirement
  - Each state describe at least 5 percent of its locations currently exhibiting the most severe highway safety needs, in accordance with Sections 148(c)(1)(D) and 148(g)(3)(A), of Title 23, *United States Code*
  - Location should have at least one crash (fatal, any type of injury or property damage only) in each of the three years.
  - Location should have at least one fatal crash in three years.
  - At least one crash should be run-off-road, intersection, or pedestrian related. It should be noted that the intersection-related crashes considered here are the crashes in which the first harmful event occurred on an approach to or exit from an intersection, and resulted from an activity, behavior or control related to the movement of traffic units through the intersection (as defined by the American National Standard D16.1-1996, ANSI D16.1-1996).
  - Total number of fatal or incapacitating injury crashes equal to or greater than three in those three years.

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Roadway Assessment – Safety analysis

- State Route 83, Post Mile 44
  - Classified as top five percent
- Any correlation on
  - Seasonal effect?
  - Traffic volume?
  - Roadway geometry?

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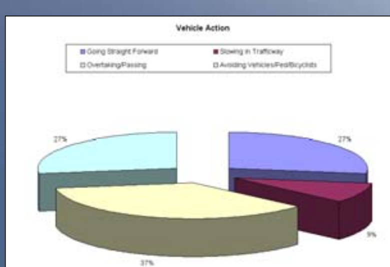
Roadway Assessment – Safety analysis



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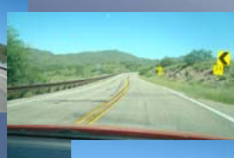
Roadway Assessment – Geometric analysis

Narrow shoulder (1')

Steep curvature without guard rail next to downhill slope

Roadway Assessment – Geometric analysis



Contributing poor sight distance

Steep horizontal curvature with narrow shoulder and poor sight distance

No median/refuge lane

Roadway Assessment – Geometric analysis

- Safety elements
  - Curvature
  - Shoulder width
  - Lane configuration – maybe suggest the refuge lane or median
  - Provide sufficient
    - Stopping sight distance
    - Passing sight distance
    - Curve radius
    - Superelevation

Findings

- Load of additional truck
  - Does not necessarily worsen traffic operation based on LOS
  - Does affect corridor delay
  - Need to correct with geometry improvements
- Accident analysis
  - High correlation with roadway geometry rather than truck traffic
- Few items to suggest for alternatives???

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Questions

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Traffic Study

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James A. Tress, Jr., M.N.S.
Project Principal

Mr. Tress has 25 years experience in environmental issues. He manages interdisciplinary teams responsible for preparation of a variety of environmental documents, including environmental impact statements (EIS) and assessments (EA); wetland and jurisdictional waters delineations; Section 404(b)(1) alternatives analysis and habitat mitigation and monitoring plans in support of Clean Water Act Section (CWA) 404 permitting; surveys and biological assessments in support of Endangered Species Act (ESA) clearance and Section 7 and 10a permitting; natural resources planning and management; ecological resources survey and baseline studies; and mitigation design and planning. Jim specializes in the technical and procedural requirements necessary for compliance with regulatory programs implemented under the CWA, ESA, and National Environmental Policy Act (NEPA). Services provided in support of these regulatory programs include environmental planning, delineation of jurisdictional waters and wetlands, habitat evaluation and endangered species survey and assessment, EIS and EA preparation, Section 404(b)(1) alternative analysis and mitigation planning, and public participation plan development mandated by NEPA. Mr. Tress also has extensive experience in the development and implementation of mitigation and restoration planning for riparian, wetland, desert, and montane habitats.

Mr. Tress is and has been the primary permit holder since 1997 for WestLand's Federal Fish and Wildlife Permit issued by the U.S. Fish & Wildlife Service (USFWS) and Scientific Collecting Permit issued by the Arizona Game & Fish Department. He supervises fieldwork and report preparation for the CFPO and other special-status species survey throughout Arizona.

WestLand Resources, Inc.
Engineering and Environmental Consultants
Tucson • Phoenix

Brian S. Lindenlaub
Senior Project Manager, Environmental Resources

B.S. Geology
B.S. Fisheries and Wildlife

Mr. Lindenlaub has 13 years of environmental experience, specializing in environmental permitting and compliance, site investigations, and remediation activities. His project experience includes environmental permitting (NEPA, CWA) and compliance (Resource Conservation and Recovery Act [RCRA] and Comprehensive Environmental Response, Compensation, and Liability Act [CERCLA]) in addition to extensive field experience in soil and groundwater investigations. Specific projects Mr. Lindenlaub has worked on include NEPA permitting, CWA Section 404 permitting, Arizona Department of Transportation environmental checklists, and numerous biological evaluations and assessments. He has performed Phases I and II Environmental Site Assessments (ESA and CERCLA) for industrial and commercial facilities. His experience in wildlife science includes habitat assessments and field-intensive waterfowl studies.

Robert J. Schmalzel, M.S.
Senior Scientist

Mr. Schmalzel has over 16 years of field experience in Arizona, Texas, Iowa, and Panama. He has a Masters Degree in Entomology from the University of Arizona and these interests have resulted in the identification of a new species of weevil (*Gerstaeckeria*), which along with a group of pyralid moths, may have important implications on the population dynamics of a cactus listed as endangered in Southern Arizona. Mr. Schmalzel is currently working with acknowledged expert in this taxon to describe this new species. He is knowledgeable of insect systematics, insect collections, and insect natural history. Mr. Schmalzel developed study plots for *E. horizonthalonius* and *C. scheeri,* which are the largest sets of any endangered or threatened cactus in the United States. The data collected from these long-term monitoring plots will be used to develop demographic and spatial descriptions that will contribute to the understanding of the reported endangerment of these species.

His chosen field of research is conservation biology, with a particular interest in how small populations of plants persist in the Southwest. He studies demographic characteristics of cactus populations, with a special interest in rare cactus species. Within the broad geographical regions in which he has worked, Mr. Schmalzel has had the opportunity to work in deserts, mangroves, savannahs, rainforests, thorn scrub, oak woodlands, coniferous forests, croplands, and mountains (many ranges in Arizona, the Serranía de Tabasará, and Volcán Barú in Panamá). He conducted extensive plant collecting and has become well acquainted with each of the floras from a systematic, ecological, and palynological point of view. Mr. Schmalzel's research in Panama involved monitoring and observational techniques. Work in Arizona includes manipulation of subjects in the field, ecological survey, long-term monitoring, and laboratory experimentation.

Rosemont 2008 Baseline Biology Survey

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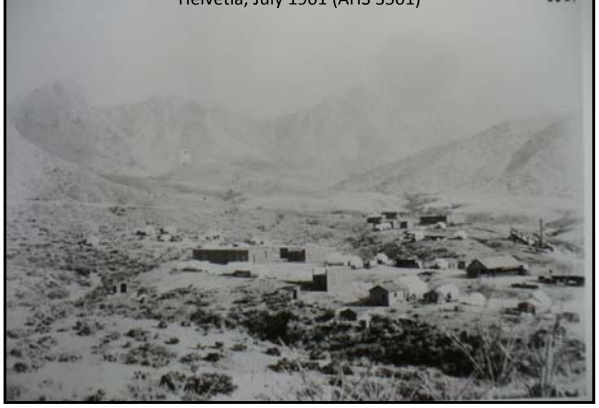
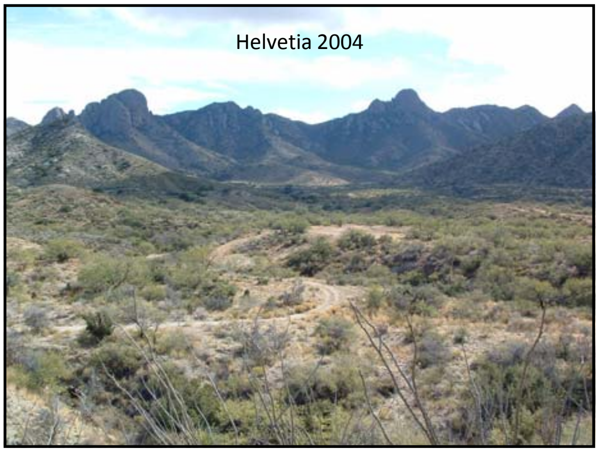
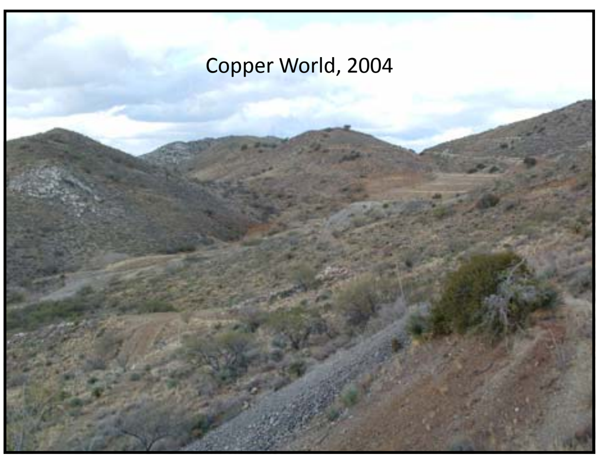
Helvetia, Schrader (1909)

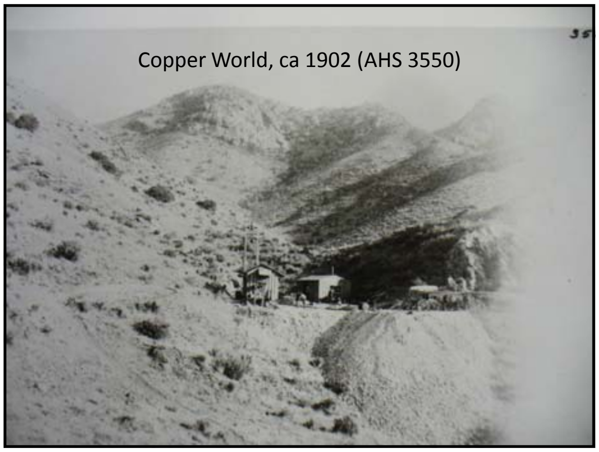
Helvetia, July 1901 (AHS 3501)




Helvetia 2004

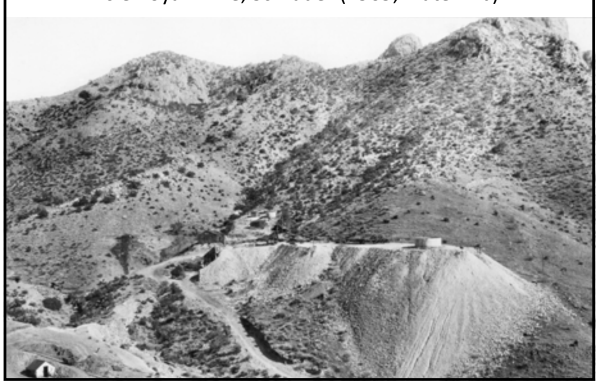

Copper World, Schrader (1909)


Copper World, 2004

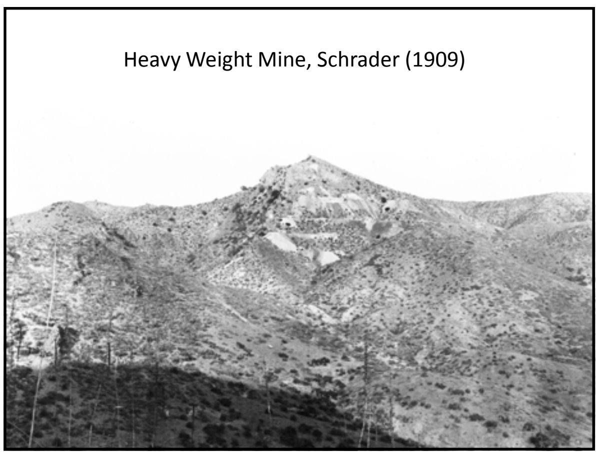

Copper World, ca 1902 (AHS 3550)


Copper World, 2004

Isle Royal Mine, Schrader (1909, Plate XIIb)




Isle Royale, 2004

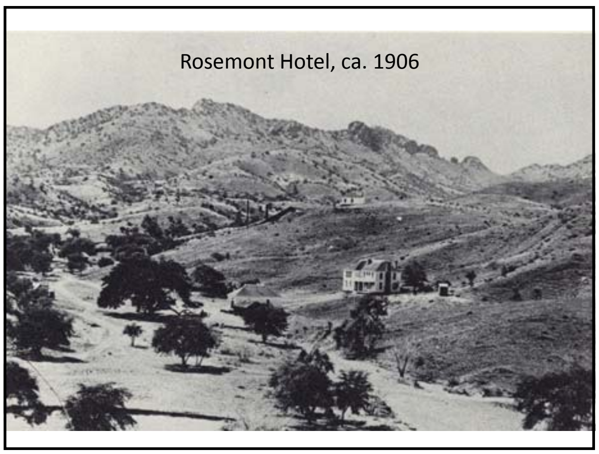

Heavy Weight Mine, Schrader (1909)


Heavy Weight Mine, 2004

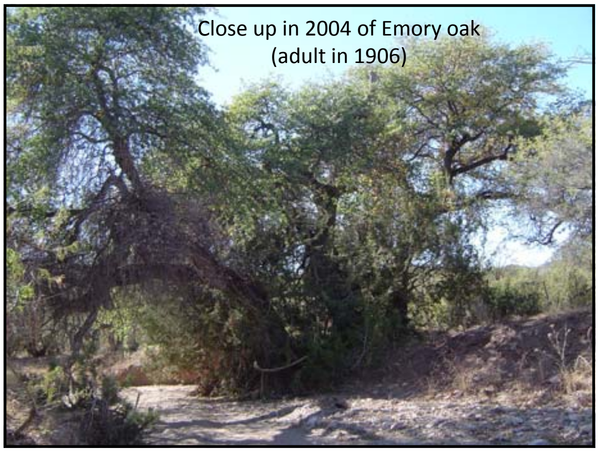
Ridge at Coconino fault, C. Popoff (1940, VIIIb)

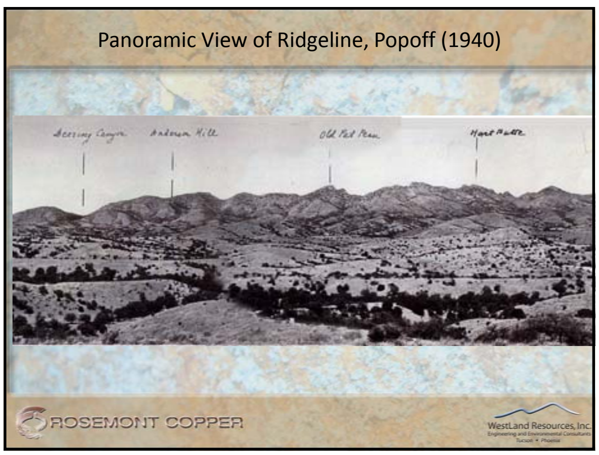
Rosemont smelter, Popoff (1940,VIIa)


Rosemont Smelter, 2004


Rosemont Hotel, ca. 1906


Rosemont Hotel, 2004


Close up in 2004 of Emory oak
(adult in 1906)


Panoramic View of Ridgeline, Popoff (1940)
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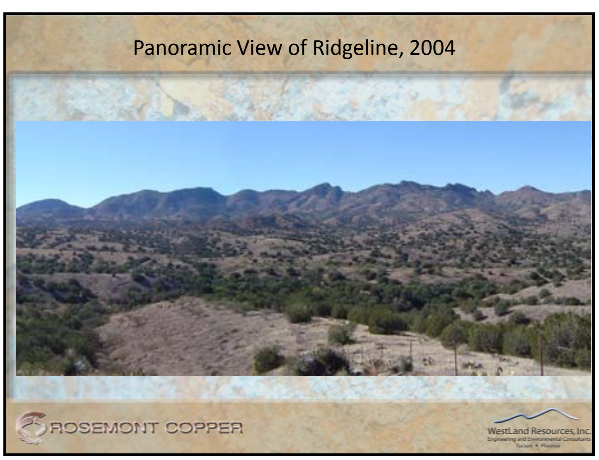
WestLand Resources, Inc.


Panoramic View of Ridgeline, 2004
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Pima pineapple cactus (PPC)
(*Coryphantha scheeri* var. *robustispina*)

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Objectives of PPC survey

- Survey for PPC along a 15.8-mile 120-footwide (229-acre) proposed route for the water line from near Sahuarita to Helvetia
- Map the location of each PPC plant and determine on which alluvial units this cactus was found in this survey.

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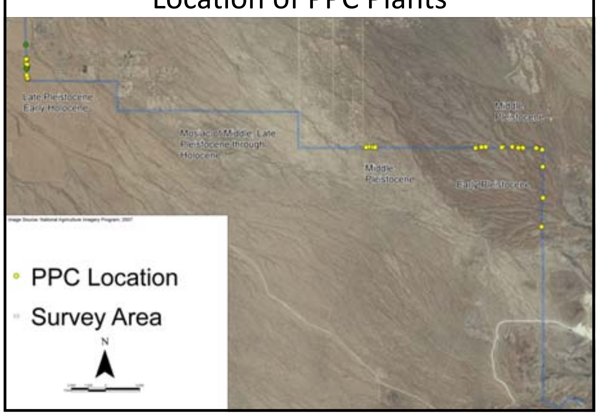
Location of PPC Plants



Results of PPC Survey

- 35 PPC plants were located during the survey in October 2008
- 19 of these plants occurred on very old (early to middle Pleistocene) alluvial deposits near the mouth of Sycamore Canyon. About half of these were on the red clay surface; the other half were in areas incised or veneered with younger soils.
- 16 plants occurred on late Pleistocene to early Holocene alluvium on the edge of the Santa Cruz floodplain.

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Results of PPC Survey

- No PPC were found in the intervening region along the survey route.
- Based on Bureau of Reclamation surveys for PPC on the Santa Rita Experimental Range and surveys towards Corona de Tucson, the longer alluvial surfaces have been stable (middle to early Pleistocene), generally the more PPC plants are found.

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Palmer's Agave (*Agave palmeri*)

Objectives –Agave Impact Area

- Determine overall density of agave rosettes in impact area
- Determine density of successful flowering stems in impact area
- Determine impacts of herbivory on success of flowering stems in impact area
- Determine size class structure of population as representative of age class structure

Objectives –Agave Regional Area

- Estimate density of agave rosettes in regional area
- Determine density of successful flowering stems in regional area
- Make comparisons with impact area

Methods – Impact Area:

- Subset of 1 ha units selected at random from all ha units in impact area
- Detailed count of all agaves, by size class, in 0.25 ha portion of random unit
- Count of all current flowering stems and flowering stems from previous years, including those lost to herbivory, with size measurements of flowering rosettes

Methods – Impact Area:

- Count of all successful flowering stems on 1 ha sampling unit
- Additional information on slope aspect, geological substrate, and presence of drainages

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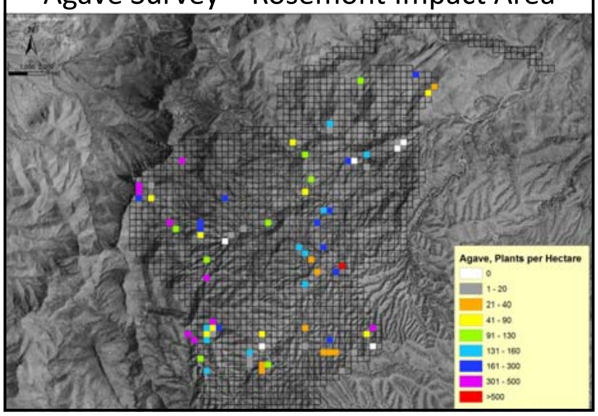
Agave Survey – Rosemont Impact Area



Methods – Regional Area:

- Three scales for analysis:
  - Within Rosemont Property but outside of impact area
  - Within 5 mi circle centered in proposed project location
  - Within 20 mile circle centered in proposed project location
- Randomly selected points along public access roads

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Methods – Regional Area:

- Count all rosettes and current, successful flowering stems within quadrant selected at random
- Map counting area on lap-pad computer with detailed aerial photography of region
- Additional information on slope aspect, geological substrate, and presence of drainages

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Agave Survey Plots – Regional Area

Agave Plots

5 Mile Radius

Agave Survey Results –Impact Area

- 76 one-hectare plots surveyed
- Rosette density range from 0 to 1,088 plants/ha
- Mean rosette density is 140.2 plants/ha (standard deviation 166.7; standard error of ±19.12)
- Flowering stem density range from 0 to 13/ha

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Agave Survey Results –Impact Area

- Flowering stem density is 2.91/ha (std. dev. 3.76, s.e. ±0.43)
- Geological substrate and slope aspect had no significant effect on agave density
- Herbivory has significant impact, causing the loss of 58% of current year flowering attempts
- Long-term herbivory impact is about 46% of all flowering attempts

Evidence of Herbivory

Agave Survey Results – Regional Area

- 117 plots surveyed – Total area = 500 ha
- Rosette density range from 0 to 340 plants/ha
- Mean rosette density is 12.3 plants/ha, (standard deviation 37.8; standard error of ±3.49)

Agave Survey Results – Regional Area

- Flowering stem density range from 0 to 57.1/ha
- Flowering stem density is 2.78/ha (std. dev. 8.56, s.e. ± 0.79)

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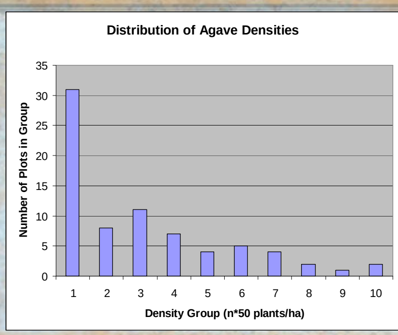
Distribution of Agave Densities



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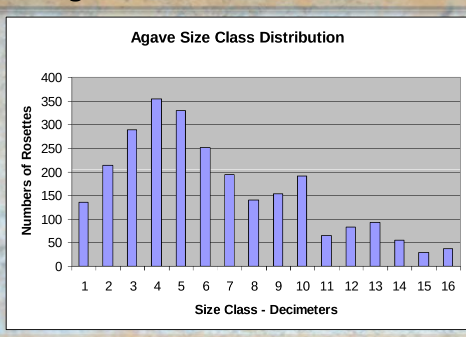
Agave Size Class Distribution



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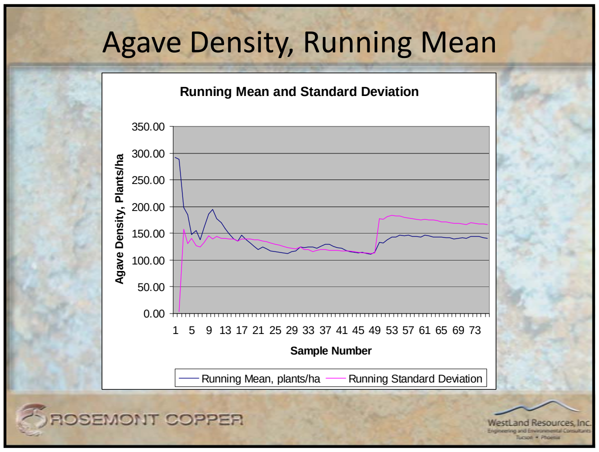
Agave Density, Running Mean
Running Mean and Standard Deviation
350.00
300.00
250.00
200.00
150.00
100.00
50.00
0.00
Agave Density, Plants/ha
1 5 9 13 17 21 25 29 33 37 41 45 49 53 57 61 65 69 73
Sample Number
Running Mean, plants/ha
Running Standard Deviation
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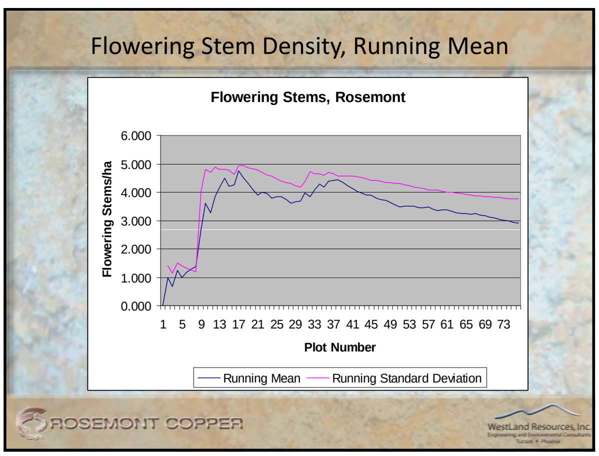
Flowering Stem Density, Running Mean
Flowering Stems, Rosemont
6.000
5.000
4.000
3.000
2.000
1.000
0.000
Flowering Stems/ha
1 5 9 13 17 21 25 29 33 37 41 45 49 53 57 61 65 69 73
Plot Number
Running Mean
Running Standard Deviation
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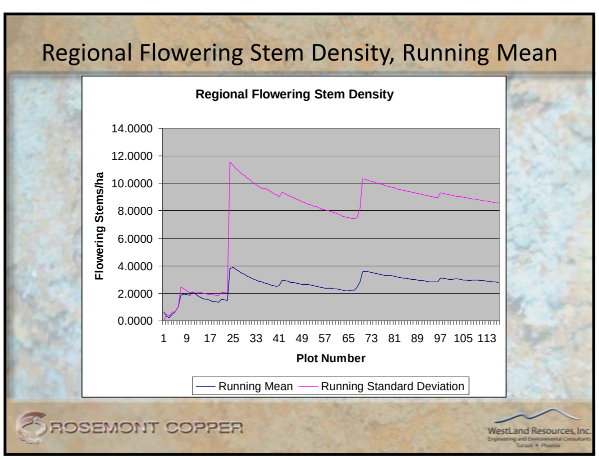
Regional Flowering Stem Density, Running Mean
Regional Flowering Stem Density
14.0000
12.0000
10.0000
8.0000
6.0000
4.0000
2.0000
0.0000
Flowering Stems/ha
1 9 17 25 33 41 49 57 65 73 81 89 97 105 113
Plot Number
Running Mean
Running Standard Deviation
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Conclusions 1:

- Palmer's agaves on the Rosemont Site provide a significant foraging resource for lesser long-nosed bats during their late summer, post-maternity dispersal
- Agave densities in impact area and in regional area are highly variable and have no obvious relationships with substrate or slope aspect
- Rosemont Impact Area has size class distribution that indicates normal, healthy population of agaves

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Conclusions 2:

- Herbivory has significant impact on flowering success
- No difference in successful flowering stem density between impact area and regional area
- Rosemont Impact Area provides nothing unique with regard to agave populations
- Sampling for agave rosette density on regional scale is not representative of actual populations

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Lesser Long-Nosed Bat (*Leptonycteris yerbabuenae*)

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LLNB Survey Objectives

- Evaluate bat foraging on Rosemont Property
- Evaluate bat foraging outside of Impact Area
- Evaluate bat roosting on Rosemont Property
- Evaluate bat roosting regionally

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LLNB Survey Methods

- Ultrasonic acoustic and infrared surveys on Rosemont Property
- Ultrasonic acoustic and infrared surveys outside of Impact Area
- Potential roost site surveys on Rosemont Property
- Potential roost site surveys in regional area

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Acoustic Survey Locations

- Between McCleary and Scholefield Canyons
- East Side of Gunsight Pass
- Box Canyon
- Near Scholefield Spring
- Upper McCleary Canyon

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Flowering Agave

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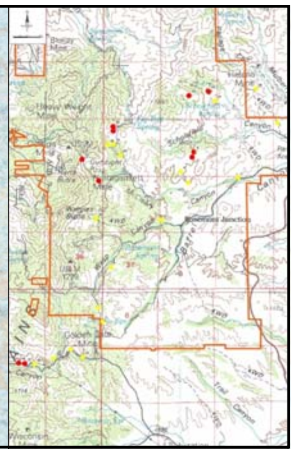
Active and Passive Sensor Locations

- Active Sensor
- Passive Sensor



Active Set-up at Flowering Agave

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Passive Set-up at Flowering Agave

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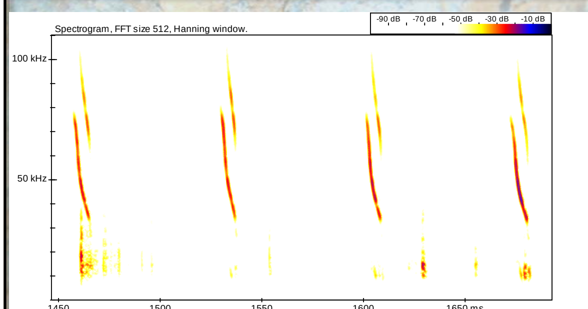
LLNB Sonogram



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Acoustic Survey Results - 1:

- LLNB recorded at 23 out of 27 sensor locations
- Mexican long-tongued bat (MLTB) recorded at 4 out of 27 sensor locations
- Intensity of foraging activity increased with decrease in flower availability

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Acoustic Survey Results - 2:

- Foraging intensity highly variable, from 0 to over 500 hits on an agave flower in 2 hours
- Foraging is frequently visual, with no ultrasonic calls
- At least one bat species recorded at all locations

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Acoustic Survey Results – 3:

- 7 species identified, at least 10 species recorded
- Gunsight Pass appears to be corridor for several species of bats (at least 9 recorded)
- Other species: big brown bat, fringed myotis, pocketed free-tailed bat, western pipistrel, Brazilian free-tailed bat

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Foraging Activity

- LLNB foraging on agave flower

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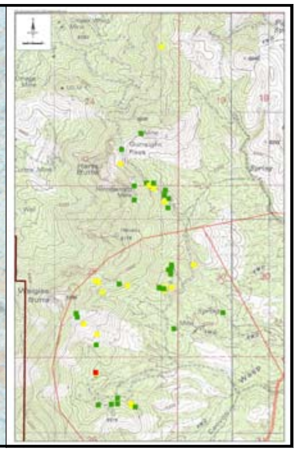
Potential Roost Locations – Impact Area

- Gunsight Pass Vicinity
- Between McCleary and Wasp Canyons
- Head of Wasp Canyon

Potential Roost Sites Examined

- No Evidence of Bats
- Some Evidence of Bats, or Undetermined Potential
- Confirmed Presence of LLNB



Potential Roost Site

Potential Roost Locations – Regional Area

- Empire Mountains
- Mulberry Canyon
- West Side of Gunsight Pass
- Box Canyon Vicinity
- Greaterville Vicinity

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Potential Roost Locations – Regional Area

- Fish and Sawmill Canyons
- Cave Canyon
- Gardner Canyon
- Temporal Gulch

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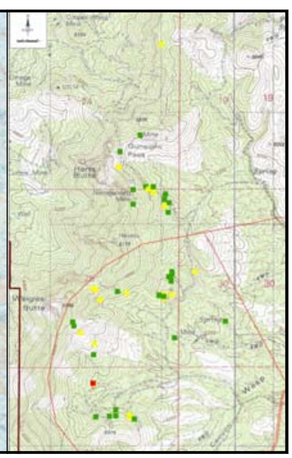
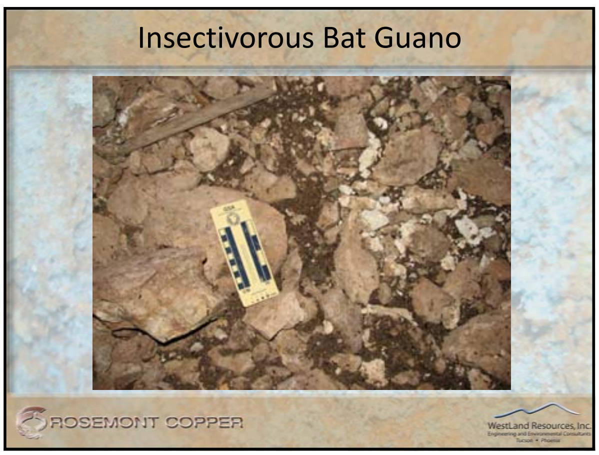
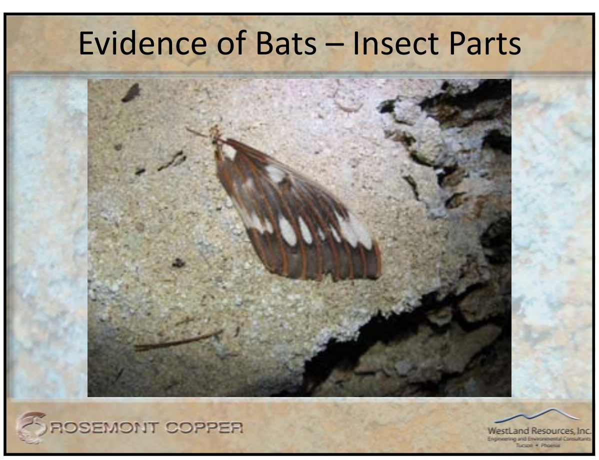
Potential Regional Roost Sites Examined

- No Evidence of Bats
- Some Evidence of Bats, or Undetermined Potential
- Confirmed Presence of LLNB




Nectivorous Bat Guano Splatter
ROSEMONT COPPER
WestLand Resources, Inc.


Insectivorous Bat Guano
ROSEMONT COPPER
WestLand Resources, Inc.


Evidence of Bats – Insect Parts
ROSEMONT COPPER
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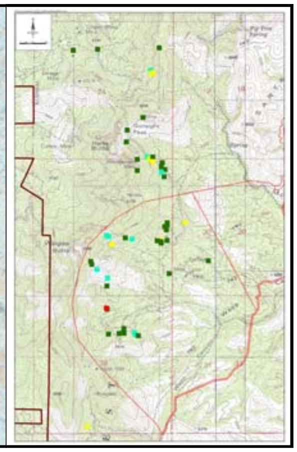
Roost Sites - Rosemont

- No Evidence of Bats
- Evidence of Insectivorous Bats or Unknown Potential
- Evidence of Nectar Feeding Bats
- Confirmed Presence of LLNB



Roost Survey Summary 1

- Total of 105 sites examined
- LLNB confirmed presence in 6 sites
- MLTB confirmed presence in 14 sites
- Evidence of nectar-feeding bats in 21 sites

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Roost Survey Summary 2

- 43 sites have evidence of bat use
- Insectivorous bat species observed: cave myotis, Townsend’s big-eared bat, fringed myotis, and big brown bat

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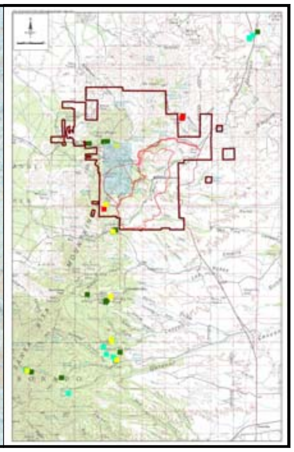
Regional Roost Sites

- No Evidence of Bats
- Evidence of Insectivorous Bats or Unknown Potential
- Evidence of Nectar Feeding Bats
- Confirmed Presence of LLNB



Conclusions – LLNB Foraging

- Agaves on Rosemont Site and surrounding areas are heavily used by LLNB for late summer foraging
- It is likely that every flowering agave will be visited by LLNB at some point during this season
- Rosemont provides an important foraging resource

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Conclusions – Bat Roost Sites 1

- Many abandoned mines in Rosemont Impact Area and in the surrounding vicinity appear to provide suitable roosting habitat for LLNB
- Evidence of nectar-feeding bats (LLNB or MLTB) observed in 21 sites
- LLNB presence confirmed in low numbers in only one adit in Rosemont Impact Area

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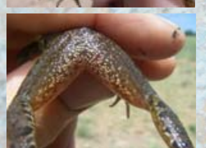
Conclusions – Bat Roost Sites 2

- LLNB presence confirmed in low numbers in one adit on Rosemont Unpatented Claim Area
- LLNB presence confirmed in good numbers in four adits in the vicinity.

Chiricahua Leopard Frog (*Rana* [=*Lithobates*] *chiricahuaensis*)



Objectives of Ranid Survey

- Identify potential suitable habitat for ranids within the Impact Area
- Determine the presence or absence of ranids (particularly Chiricahua leopard frog) within the Impact Area and surrounding areas
- Identify the likely source of dispersing ranids (Chiricahua leopard frog) in the Rosemont Vicinity

Ranid Survey Methods

- Survey of drainages, tanks, and springs within the Impact Area in search of suitable habitat
- Visual Encounter Survey Method within features supporting suitable habitat
- Dip net capture and call playback for identification purposes
- Precautions for disease prevention

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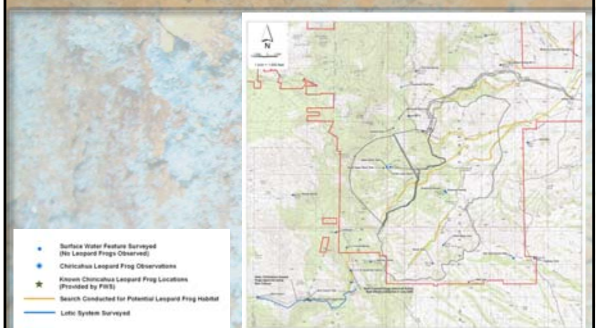
Ranid Survey Areas



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Chiricahua Leopard Frog Findings

- One Chiricahua leopard frog observed within the Impact Area – Lower Stock Tank
- Frogs observed outside the Impact Area but within the Rosemont Property
  - Oak Tree Canyon (One Chiricahua leopard frog)
  - Highway Tank (One Chiricahua leopard frog)

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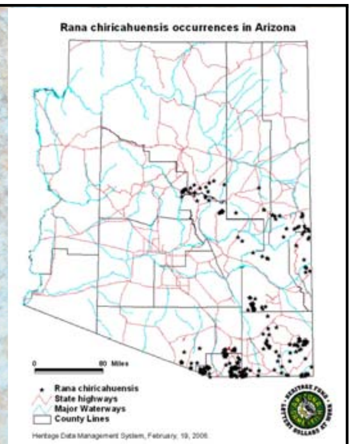
Chiricahua Leopard Frog Findings

- Frogs observed outside the Rosemont Property
  - East Dam (One Chiricahua leopard frog)
  - Box Canyon (Several Chiricahua leopard frogs)
  - Sycamore Spring and Sycamore Canyon (Two Chiricahua leopard frogs)
  - Lower Davidson Canyon above Cienega Creek (Several lowland leopard frogs)

Known Chiricahua Leopard Frog Distribution



Sonorella species in the Rosemont area

Sonorella rosemontensis Pilsbry

- Described as a new species by Pilsbry in 1939
- Type locality "northern end of the Santa Rita Mountains near Rosemont (J. H. Ferriss), Type 166642 A.N.S.P.; Helvetia; Greaterville"
- Pilsbry's (1939) treatment of *S. rosemontensis* would suggest this species is a narrow endemic restricted to an area somewhere near Rosemont

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Objectives of Field and Literature Surveys

1. Review the taxonomic literature on *Sonorella rosemontensis*, the descriptions of the type specimens used, and the concept(s) of species used by the biologists working with *Sonorella*.

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Objectives of Field and Literature Surveys

2. Conduct field surveys for *Sonorella* (on talus slopes and scree) in the Rosemont project area and other areas of the Santa Rita Mountains.

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Objectives of Field and Literature Surveys

3. Visit talus slopes to observe how active the slopes are in terms of the addition of new rock spalling from above, areas of slope failure, and areas of relatively stable slopes.

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Taxonomy of *Sonorella rosemontensis* Timeline

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Sonorella rosemontensis

- *S. rosemontensis* shell is like *S. hesterna* or *S. walkeri* shells.
- *S. rosemontensis* verge is not spirally groved (as first described) but is nearly identical to *S. walkeri*.
- *S. walkeri* has been collected in Agua Caliente Canyon (Soldier Canyon), Madera Canyon, in the southwestern Santa Ritas (Josephine Canyon towards San Cayetanos), and Pajarito Mountains. *S. walkeri* is also closely related to *S. huachucana*, a species that occurs in the Huachuca, Patagonia, and Santa Rita Mountains, and as a fossil species in the Mustang Mountains.

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Sonorella rosemontensis

- In 1978, Miller wrote that "it is the opinion of the author [Miller] that *S. rosemontensis* is at least conspecific with *S. walkeri* and may possibly be a synonym" (p. 111).

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Surveys for *Sonorella rosemontensis* in the Rosemont area

- Walter Miller searched for this species during six field trips from Oct. 1975 to May 1976. He visited 18 localities (identified to ¼ of ¼ sections). Miller found *S. rosemontensis* in only two of the 18 localities.
- WestLand searched for this species during 20 field trips from July 14 to October 1, 2008. Surveys coincided with the monsoon season. Field trips provided coverage of most of the Rosemont project area and included areas outside of the Rosemont area (Fish Canyon, Mt. Hopkins, Agua Caliente Canyon, and Gardner Canyon).

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Surveys for *Sonorella rosemontensis* in the Rosemont area

- *Sonorella* shells and in some cases live snails (with an AGFD permit) were collected by WestLand in 14 localities in or near the Rosemont project area. Snails were also observed mating, with eggs, and feeding.

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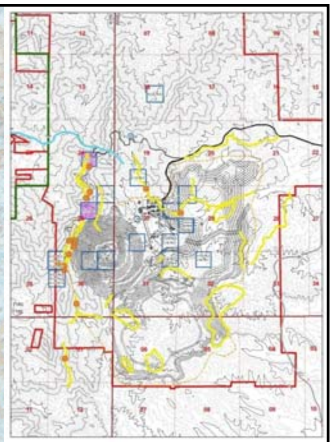
Sonorella snails mating

Rosemont Area Talus Snail Survey



Talus Slopes

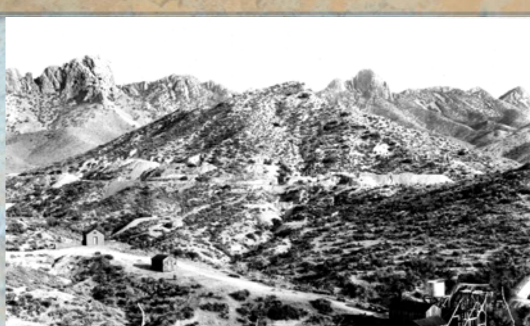
- Provide humid refugia for *Sonorella*, some protection from predators (mice, flies, beetles), and food (lichens, plants, fungi).
- Deep extensive talus on the west slopes of the Rosemont area may provide microsites more like sites at higher elevations around Mt. Wrightson.

Fungus growing on rocks buried within a humid talus slope, August 2008

Talus Slopes

- Talus slopes are persistent and dynamic.
- Most of the talus slopes along the ridge west of the Rosemont project area are composed of quartzite. Quartzite is resistant to weathering; erosion of this ridgeline (over the last ca 1 my) is coupled to rate of erosion of the Bolsa quartzite bed.
- As such, these quartzite talus slopes are dynamic but persistent features, with particular talus slopes probably lasting 100,000 years or more.

View of west slope (Schrader 1909)



Same view of west slope in 2004

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Google Earth image of north ridge talus slopes

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Shallow talus slope on east side of ridge

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Long talus

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Sonorella habitat

- View along edge of talus, relatively stable, more lichens and shrubs

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Trees along edge of talus slope

- Deep quartzite talus slope, west side

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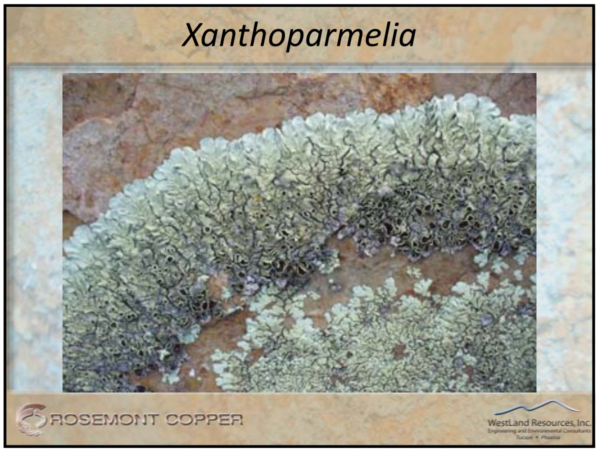
Xanthoparmelia
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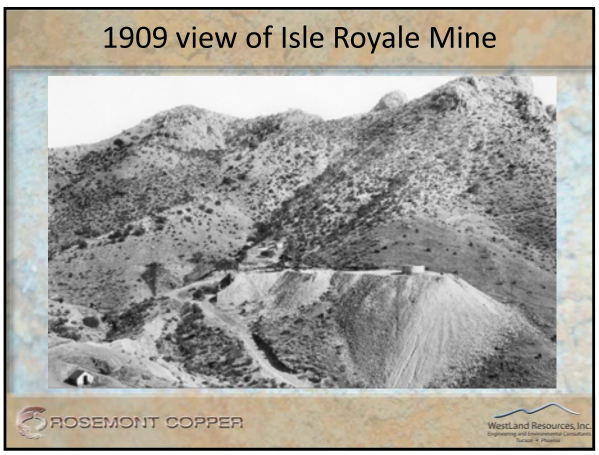
1909 view of Isle Royale Mine
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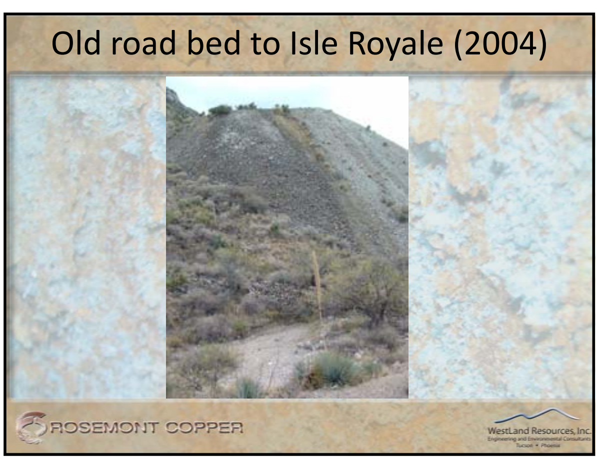
Old road bed to Isle Royale (2004)
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Retaining wall of old road bed to Isle Royale

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Pleopsidium

a chartreuse crustose lichen, on freshly spalled surfaces of quartzite

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Freshly spalled bedrock surface of quartzite with *Pleopsidium*

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Stable rock with *Xanthoparmelia*

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Looking downslope, active rock slides

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Active center with quiet edges

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Talus slopes

- Unstudied in the Southwest United States
- Rock spall along the quartzite ridge appears to be ongoing, at least above the major talus slopes

Talus slopes

- Not yet understood if rate of rock spall is constant between pluvial and interpluvial periods

Dr. Jeffrey S. Fehmi, PhD
UofA Faculty

Dr. Fehmi joined the faculty of the School of Natural Resources in August 2005. He is in the Rangeland and Forest Resources Group and teaches Rangeland Inventory and Monitoring (RA M 456/556), Rangeland Planning (RA M 487/587), and Vegetation Management (RA M 446/546). He has an active research program in rangeland related disturbance and restoration.

Previously, Dr. Fehmi was a research ecologist in the military lands research program with ERDC/CERL US Army Corps of Engineers in Champaign, Illinois. His research program focused on the impacts of military training activities on military lands across the west and mid-west.

Dr. Fehmi was also a Range Scientist at the Northern Great Plains Research Laboratory in Mandan, North Dakota, and completed a post-doctoral appointment at the University of California at Davis.

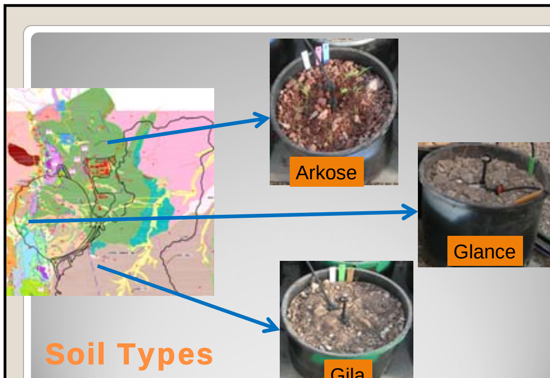
Research on Mineland Reclamation

Jeffrey S. Fehmi
School of Natural Resources
University of Arizona

Outline

- Experimental design
  - **Soil types**
    Arkose, Gila, Glance
  - **Rainfall scenarios**
    High, Average, Low
  - **Amendments**
    None, Straw, Straw + Fertilizer
  - **Seed mixes**
    29 native species: 4 mixes
- Results and recommendations

Soil Types

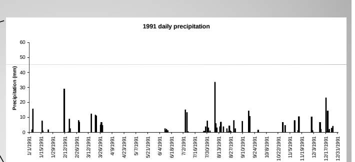


- **Low rainfall**
  - 245 mm (9.6 in)
- **Average rainfall**
  - 384 mm (15.1 in)
- **High rainfall**
  - 510 mm (20.1 in)

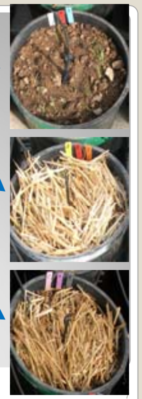
- **Summer**
  - 90 days
  - Monsoon season temperatures
- **Between seasons**
  - 60 days
  - Moderate temps
  - No watering
- **Winter**
  - 90 days
  - Cool-season temperatures

Rainfall / climate scenarios

Rank (low to high)	Year	Average precip. (mm)	
1	1995	228.9	
2	2004	277.6	
3	1989	280.3	
4	1980	285.0	Low year
5	2002	292.5	
6	2006	293.5	
7	1996	305.9	
8	1976	309.5	
9	2005	311.2	
10	2003	311.9	
11	1986	336.4	
12	1997	338.5	
13	2001	344.4	
14	1979	365.9	
15	1991	398.4	Ave. year
16	1977	422.9	
17	1994	423.0	
18	1982	428.1	
19	1985	431.7	
20	1981	448.1	
21	1993	449.8	
22	1999	488.4	
23	1992	500.4	
24	2000	507.7	
25	1998	515.9	
26	1987	522.2	
27	1988	523.4	
28	1990	532.3	High year
29	1978	569.2	
30	1983	581.2	
31	1984	735.5	
	average	411.6	



- **None** – bare soil.
- **Straw** – equivalent to 2 tons per acre, tackified.
- **Straw + Fertilizer** – equivalent to 2 tons per acre, tackified + slow release fertilizer.



Amendments

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Common Name	Scientific Name
whitethorn acacia*	*Acacia constricta*
catclaw acacia*	*Acacia greggii*
red threeawn	*Aristida purpurea var. longiseta*
fourwing saltbush*	*Atriplex canescens*
desert marigold	*Baileya multiradiata*
cane beardgrass*	*Bothriochloa barbinodis*
sixweeks needle grama	*Bouteloua aristidoides*
sideoats grama*	*Bouteloua curtipendula*
blue grama*	*Bouteloua gracilis*
Rothrock grama*	*Bouteloua rothrockii*
false mesquite	*Calliandra eriophylla*
Arizona cottontop	*Digitaria californica*
bottlebrush squirreltail	*Elymus elymoides*
plains lovegrass*	*Eragrostis intermedia*
Mexican gold poppy	*Eschscholzia californica ssp. mexicana*
tanglehead*	*Heteropogon contortus*
curly mesquite	*Hilaria belangeri*
orange caltrop	*Kallstroemia grandiflora*
prairie Junegrass	*Koeleria macrantha*
green sprangletop*	*Leptochloa dubia*
big purple tansyaster	*Machaeranthera tanacetifolia*
muttongrass	*Poa fendleriana*
whitestem paperflower	*Psilostrophe cooperi*
skunkbush sumac*	*Rhus trilobata*
desert senna	*Senna covesii*
desert globemallow	*Sphaeralcea ambigua*
gooseberryleaf globemallow	*Sphaeralcea grossulariifolia*
sand dropseed*	*Sporobolus cryptandrus*

Mix 1

sideoats grama
blue grama
green sprangletop
Rothrock grama
sand dropseed
sixweeks needle grama
bottlebrush squirreltail
desert marigold
big purple tansyaster
whitethorn acacia
skunkbush sumac

cane beardgrass
Arizona cottontop
sideoats grama
blue grama
tanglehead
sixweeks needle grama
plains lovegrass
desert senna
Mexican gold poppy
false mesquite
whitestem paperflower

cane beardgrass
Arizona cottontop
curly mesquite
red threeawn
sixweeks needle grama
muttongrass
prairie Junegrass
gooseberryleaf globemallow
orange caltrop
catclaw acacia
fourwing saltbush

red threeawn
sand dropseed
sideoats grama
Rothrock grama
sixweeks needle grama
desert senna
desert marigold
desert globemallow
Mexican gold poppy
whitethorn acacia

Seed mixes

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Common Name	Scientific Name
whitethorn acacia*	*Acacia constricta*
catclaw acacia*	*Acacia greggii*
red threeawn	*Aristida purpurea var. longiseta*
fourwing saltbush*	*Atriplex canescens*
desert marigold	*Baileya multiradiata*
cane beardgrass*	*Bothriochloa barbinodis*
sixweeks needle grama	*Bouteloua aristidoides*
sideoats grama*	*Bouteloua curtipendula*
blue grama*	*Bouteloua gracilis*
Rothrock grama*	*Bouteloua rothrockii*
false mesquite	*Calliandra eriophylla*
Arizona cottontop	*Digitaria californica*
bottlebrush squirreltail	*Elymus elymoides*
plains lovegrass*	*Eragrostis intermedia*
Mexican gold poppy	*Eschscholzia californica ssp. mexicana*
tanglehead*	*Heteropogon contortus*
curly mesquite	*Hilaria belangeri*
orange caltrop	*Kallstroemia grandiflora*
prairie Junegrass	*Koeleria macrantha*
green sprangletop*	*Leptochloa dubia*
big purple tansyaster	*Machaeranthera tanacetifolia*
muttongrass	*Poa fendleriana*
whitestem paperflower	*Psilostrophe cooperi*
skunkbush sumac*	*Rhus trilobata*
desert senna	*Senna covesii*
desert globemallow	*Sphaeralcea ambigua*
gooseberryleaf globemallow	*Sphaeralcea grossulariifolia*
sand dropseed*	*Sporobolus cryptandrus*

sideoats grama
blue grama
green sprangletop
Rothrock grama
sand dropseed
sixweeks needle grama
bottlebrush squirreltail
desert marigold
big purple tansyaster
whitethorn acacia
skunkbush sumac

Mix 2

cane beardgrass
Arizona cottontop
sideoats grama
blue grama
tanglehead
sixweeks needle grama
plains lovegrass
desert senna
Mexican gold poppy
false mesquite
whitestem paperflower

cane beardgrass
Arizona cottontop
curly mesquite
red threeawn
sixweeks needle grama
muttongrass
prairie Junegrass
gooseberryleaf globemallow
orange caltrop
catclaw acacia
fourwing saltbush

red threeawn
sand dropseed
sideoats grama
Rothrock grama
sixweeks needle grama
desert senna
desert marigold
desert globemallow
Mexican gold poppy
whitethorn acacia

Seed mixes

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Seed mixes

Common Name	Scientific Name
whitethorn acacia*	*Acacia constricta*
catclaw acacia*	*Acacia greggii*
red threeawn	*Aristida purpurea var. longiseta*
fourwing saltbush*	*Atriplex canescens*
desert marigold	*Baileya multiradiata*
cane beardgrass*	*Bothriochloa barbinodis*
sixweeks needle grama	*Bouteloua aristidoides*
sideoats grama*	*Bouteloua curtipendula*
blue grama*	*Bouteloua gracilis*
Rothrock grama*	*Bouteloua rothrockii*
false mesquite	*Calliandra eriophylla*
Arizona cottontop	*Digitaria californica*
bottlebrush squirreltail	*Elymus elymoides*
plains lovegrass*	*Eragrostis intermedia*
Mexican gold poppy	*Eschscholzia californica ssp. mexicana*
tanglehead*	*Heteropogon contortus*
curly mesquite	*Hilaria belangeri*
orange caltrop	*Kallstroemia grandiflora*
prairie Junegrass	*Koeleria macrantha*
green sprangletop*	*Leptochloa dubia*
big purple tansyaster	*Machaeranthera tanacetifolia*
muttongrass	*Poa fendleriana*
whitestem paperflower	*Psilostrophe cooperi*
skunkbush sumac*	*Rhus trilobata*
desert senna	*Senna covesii*
desert globemallow	*Sphaeralcea ambigua*
gooseberryleaf globemallow	*Sphaeralcea grossulariifolia*
sand dropseed*	*Sporobolus cryptandrus*

sideoats grama
blue grama
green sprangletop
Rothrock grama
sand dropseed
sixweeks needle grama
bottlebrush squirreltail
desert marigold
big purple tansyaster
whitethorn acacia
skunkbush sumac

cane beardgrass
Arizona cottontop
sideoats grama
blue grama
tanglehead
sixweeks needle grama
plains lovegrass
desert senna
Mexican gold poppy
false mesquite
whitestem paperflower

cane beardgrass
Arizona cottontop
curly mesquite
red threeawn
sixweeks needle grama
muttongrass
prairie Junegrass
gooseberryleaf globemallow
orange caltrop
catclaw acacia
fourwing saltbush

red threeawn
sand dropseed
sideoats grama
Rothrock grama
sixweeks needle grama
desert senna
desert marigold
desert globemallow
Mexican gold poppy
whitethorn acacia

Mix 3

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Seed mixes

Common Name	Scientific Name
whitethorn acacia*	*Acacia constricta*
catclaw acacia*	*Acacia greggii*
red threeawn	*Aristida purpurea var. longiseta*
fourwing saltbush*	*Atriplex canescens*
desert marigold	*Baileya multiradiata*
cane beardgrass*	*Bothriochloa barbinodis*
sixweeks needle grama	*Bouteloua aristidoides*
sideoats grama*	*Bouteloua curtipendula*
blue grama*	*Bouteloua gracilis*
Rothrock grama*	*Bouteloua rothrockii*
false mesquite	*Calliandra eriophylla*
Arizona cottontop	*Digitaria californica*
bottlebrush squirreltail	*Elymus elymoides*
plains lovegrass*	*Eragrostis intermedia*
Mexican gold poppy	*Eschscholzia californica ssp. mexicana*
tanglehead*	*Heteropogon contortus*
curly mesquite	*Hilaria belangeri*
orange caltrop	*Kallstroemia grandiflora*
prairie Junegrass	*Koeleria macrantha*
green sprangletop*	*Leptochloa dubia*
big purple tansyaster	*Machaeranthera tanacetifolia*
muttongrass	*Poa fendleriana*
whitestem paperflower	*Psilostrophe cooperi*
skunkbush sumac*	*Rhus trilobata*
desert senna	*Senna covesii*
desert globemallow	*Sphaeralcea ambigua*
gooseberryleaf globemallow	*Sphaeralcea grossulariifolia*
sand dropseed*	*Sporobolus cryptandrus*

sideoats grama
blue grama
green sprangletop
Rothrock grama
sand dropseed
sixweeks needle grama
bottlebrush squirreltail
desert marigold
big purple tansyaster
whitethorn acacia
skunkbush sumac

cane beardgrass
Arizona cottontop
sideoats grama
blue grama
tanglehead
sixweeks needle grama
plains lovegrass
desert senna
Mexican gold poppy
false mesquite
whitestem paperflower

cane beardgrass
Arizona cottontop
curly mesquite
red threeawn
sixweeks needle grama
muttongrass
prairie Junegrass
gooseberryleaf globemallow
orange caltrop
catclaw acacia
fourwing saltbush

red threeawn
sand dropseed
sideoats grama
Rothrock grama
sixweeks needle grama
desert senna
desert marigold
desert globemallow
Mexican gold poppy
whitethorn acacia

Mix 4

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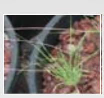
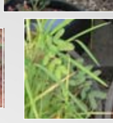
- **Functional groups**
  - WSPG - Warm-season Perennial Grasses
  - CSPG - Cool-season Perennial Grasses
  - AG - Annual Grasses
  - PF - Perennial Forbs
  - AF - Annual Forbs
  - SH - Shrubs



Species

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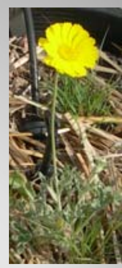
- All native species
- All expected to occur or currently occur on the site
- Derived from the NRCS Ecological Site Descriptions for the area
- All commercially available



Species

- 3 soil types X 3 rainfall scenarios X 3 amendments X 4 seed mixes = 108 treatment combinations
- 108 X 4 replications = 432 pots

Replication

Results

Green sprangletop	(*Leptochloa dubia*)	WSPG
Red threeawn	(*Aristida purpurea*)	WSPG
Blue grama	(*Bouteloua gracilis*)	WSPG
Arizona cottontop	(*Digitaria californica*)	WSPG
Curly mesquite	(*Hilaria belangeri*)	WSPG
Plains lovegrass	(*Eragrostis intermedia*)	WSPG
Bottlebrush squirreltail	(*Elymus elymoides*)	CSPG
Desert marigold	(*Baileya multiradiata*)	PF
Mexican gold poppy	(*Eschscholzia californica*	AF
False mesquite	(*Calliandra eriophylla*)	SH

Recommended species mix

Tanglehead	(*Heteropogon contortus*)	WSPG
Sideoats grama	(*Bouteloua curtipendula*)	WSPG
Sand dropseed	(*Sporobolus cryptandrus*)	WSPG
Cane beardgrass	(*Bothriochloa barbinodis*)	WSPG
Desert senna	(*Senna covesii*)	PF

Alternate species

		Soil Type			
		Arkose	**Gila**	**Glance**	**Grand Total**
Rainfall simulation	**High**	100	100	92	97
	Ave	92	100	92	94
	Low	100	83	75	86
	Grand Total	97	94	86	93

Table A1-1. *Leptochloa dubia* percent occurrence by pot.

Species analysis

		Soil Type			
		Arkose	Gila	Glance	Grand Total
Rainfall simulation	High	0	17	33	17
	Ave	0	33	25	19
	Low	0	17	25	14
	Grand Total	0	22	28	17

Table A1-17. *Acacia greggii* percent occurrence by pot.

Species not recommended

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- **Production**
  - How much aboveground biomass was produced?
- **Species richness**
  - How many species grew?
- **Functional group richness**
  - How many functional groups occurred?
- **Shannon's diversity index**
  - How even was the abundance of species?

Soils, Rainfalls, Amendments

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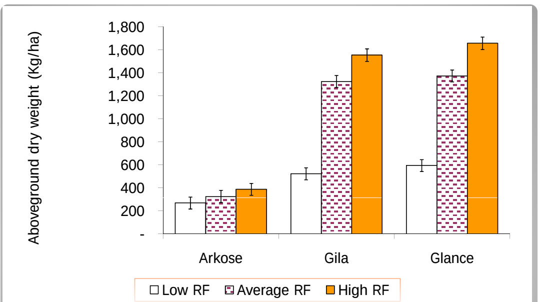

Soils and rainfall

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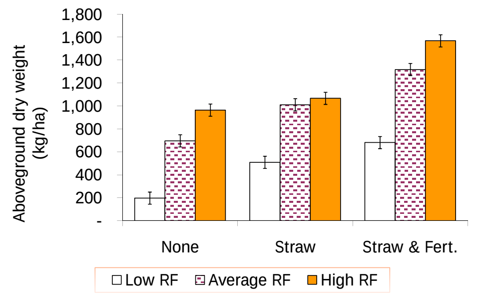

Amendments and rainfall

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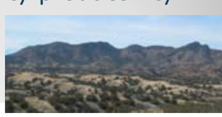
- There are species sufficient to establish a rich productive native plant community on these materials.
- Some establishment occurs even in low rainfall.
- Soils vary in productivity, Arkose supports limited richness and productivity.
- Straw aided community productivity.



Conclusions

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